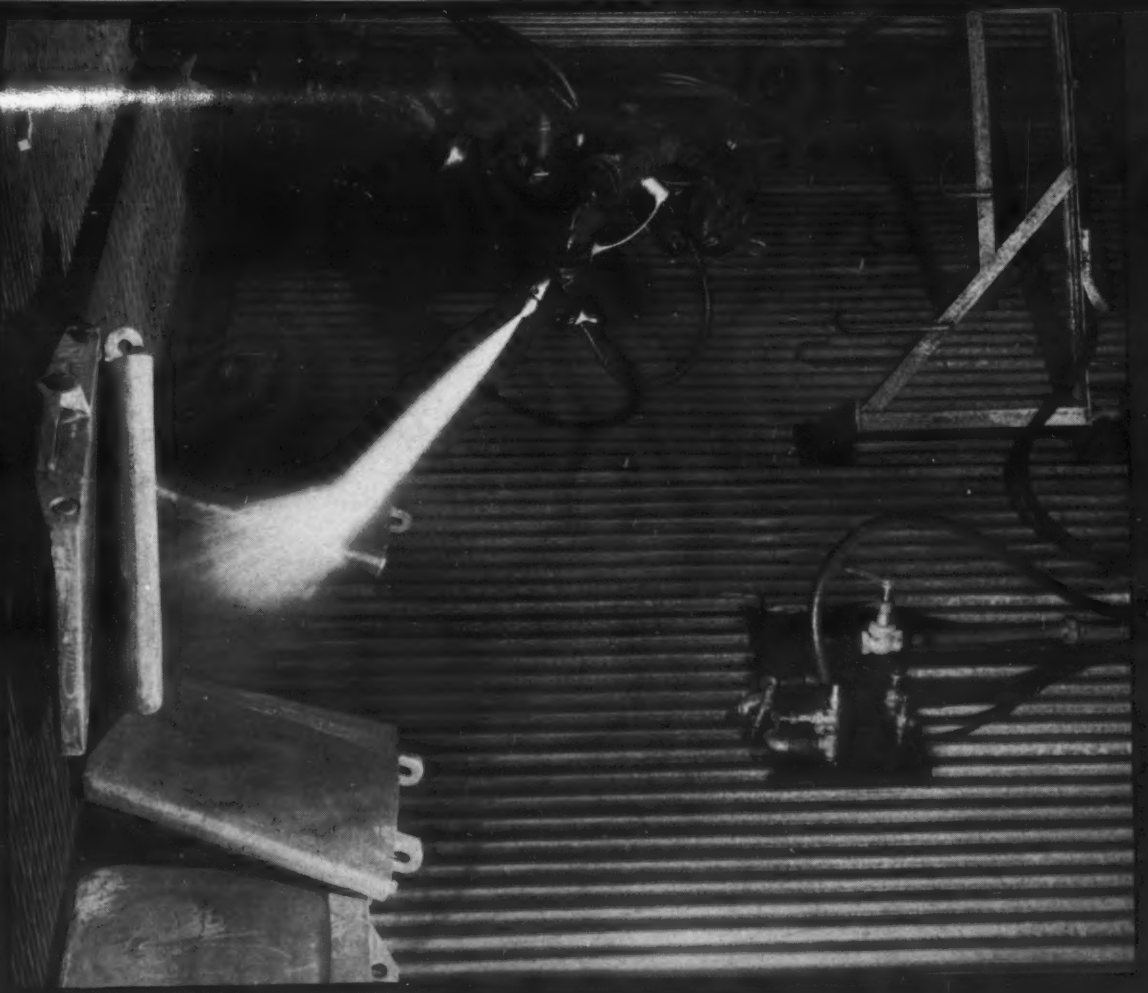

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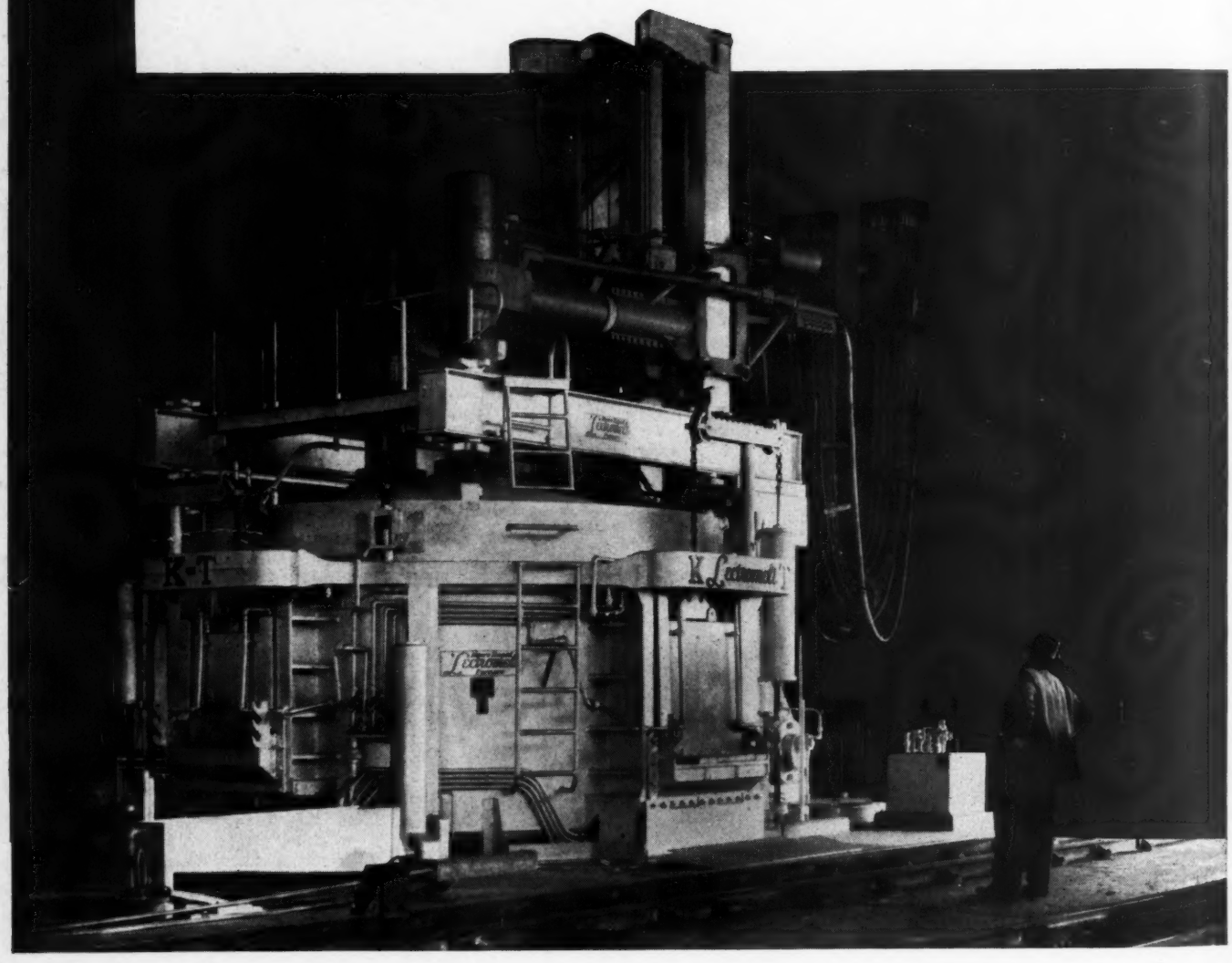

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CONTINUED INDUSTRY PROGRESS REQUIRES ORGANIZED RESEARCH

PRODUCTION OF castings developed as a craft and some of the thinking inherent in crafts has persisted down through the years. For example, the cast metal industry has held more or less rigidly to separate fields in the production of steel, gray iron, malleable, brass and bronze, and aluminum and magnesium castings and each of these branches has developed a separate and distinct trade association. Each association has carried on independently in the interests of its particular branch of the craft without coordinating its efforts with those of other foundry organizations or the industry as a whole. As a result, in World War II the cast metal industry was the only basic industry in our economy that was unprepared to give intelligent, coordinated cooperation to our armed forces and to the government.

Since the war some steps have been taken to rectify this condition. The National Castings Council has been organized with the expectation that it will become an overall policy body for the castings industry. Certain educational activities heretofore in the hands of several organizations representing the industry have been placed in the hands of a new body, the Foundry Educational Foundation. Nothing but good should come from the coordinated activities of the industry under the NCC and the FEF.

Foundry research projects today are costing the individual foundryman more money than he realizes because this work is carried on independently by a number of foundry associations. The only coordinated research activity conducted by a foundry group for the benefit of all foundrymen is that sponsored by the American Foundrymen's Society . . . and this is the only foundry organization that makes its research findings freely available to everyone.

All businessmen will agree that the present system whereby research is carried on independently by many different organizations is highly inefficient. It is a practice they would not condone in the operation of their own businesses!

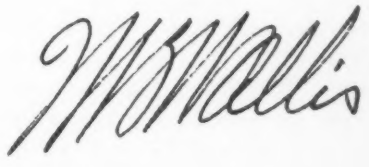
It is interesting to note that the trade associations did not originally contemplate research activities but were organized for the purposes that the name "trade association" implies. Gradually they have expanded their activities to undertake educational programs, research projects, and other technical functions. In some instances, research carried on by a particular trade association has been slanted toward results favorable only to a particular branch of the foundry craft.

Careful observers have pointed out that the development of research projects within our trade associations has not stemmed from top management within the industry. It has grown gradually, and without full realization by top management that very considerable sums now are being spent on overlapping research activities.

It seems evident that efficient handling of research in the cast metals industry calls for an overall research director. Under that man would be an assistant in charge of steel research, another in charge of gray iron, one in charge of malleable, an assistant for brass and bronze, and one for the light metals. These assistants logically should be chosen by the trade associations, each to cover a particular branch of the craft.

Coordination of research must come soon. The time surely is approaching when the foundry industry is going to rebel against wasteful expenditures for overlapping research activities.

It is to be hoped that the foundry industry can continue the progress made since World War II in coordinating its activities. Research is one of the most important of foundry activities and it cries aloud for proper coordination and management.



W. B. WALLIS, *President*
AMERICAN FOUNDRYMEN'S SOCIETY

Based on a talk made by A.F.S. President W. B. Wallis at the banquet climaxing the All-Canadian Foundry Conference held in Montreal, Que., Sept. 30 and Oct. 1. Report on the Conference appears on pages 32-36.

Dues Structure Revised . . .

DIRECTORS TAKE BOLD STEPS TO INSURE A.F.S. PROGRESS

WHEN A.F.S. CAME INTO BEING in Philadelphia, in 1896, this message formed the keynote at the inaugural meeting: *"The man who does not keep closely in touch with his competitors in these days is likely to find himself far behind in the race. No man has a monopoly of the good ideas in any branch of industry, and there is no man who is so well informed, so thoroughly conversant with the details of his own business, that he can learn nothing by discussions with his fellow manufacturers. Those who know the most, those who are most progressive in their business, are most willing to acquire new ideas which will place them still further in the lead."*

Since that time men of all branches of the industry have looked to A.F.S. as a clearing house for the most reliable technical and practical data on improved foundry practice . . . and the steady flow of such data is dependent on the work of the A.F.S. divisions, on new projects, and more research—in short, *increased service.*

A.F.S. Built on Sound Financing

It hardly need be said that maintenance of the A.F.S. services must be paralleled by sound, adequate financing, and that the financial practices and structure of the Society must be considered on an industry-wide basis. Thus, the Board of Directors of A.F.S., operating under the provisions of Art. III, Sec. 2 of the By-Laws, may find it necessary to revise from time to time the Society's service fees (member dues, publication prices, advertising rates, etc.) to meet the growing demands of a world-wide membership.

Such an action was taken by your Society's Board of Directors at a special meeting called October 4 in Chicago, when a realistic financial program was drafted to safeguard the progress of the Society without reducing the scope and quality of technical services. At this extraordinary session, every activity was carefully weighed in terms of cost and benefit to the industry, with the result that substantial reductions in operating costs were ordered.

It is essential that the Board should have the sole responsibility for maintaining, under any existing conditions, the essential services and financial stability of a technical society pledged to advance the industry through advancement of the individual. Thus, the Directors must have sufficient latitude of action to discharge their obligations to the membership.

For example, the dues structure of A.F.S. has been unchanged since July 1, 1945, when, after exhaustive study, the Board of Directors came to the conclusion that an expanded working capital was needed so that A.F.S. could adequately assist the foundry industry to gear for the opportunities of the post-war period by supplying war-expanded metalworking plants with a greater flow of information vital to systematic conversion of their capacities. Metal castings faced the competition of new materials and processes being brought aggressively to the attention of product designers.

At the same time, tremendous strides had been made in the field of metal castings . . . improved properties, new uses, better methods, stepped-up production . . . and an A.F.S. program was launched to bring these advancements to the attention of metal users. The program, announced in the April, 1945, issue of AMERICAN FOUNDRYMAN, was financed initially by increasing the dues of Company and Sustaining members, and the additional revenues obtained, in keeping with established A.F.S. policy, were cut back into the industry so the objectives of an expanded technical program could be reached.

What effect did the dues increases of July 1945 have on total membership and on revenues? The Board conservatively estimated that total dues income might increase by as much as 42 per cent in the first year; actually, the increase was 70 per cent. The Board estimated that the first year might witness a loss of some 12 per cent in the membership; actually, the membership stood at 8,539 on June 30, 1945—a net *gain* of 724.

In voting the 1945 dues increase, the A.F.S. Directors operated on the basis of advance estimates of probable expenditures; but, more often than not, actual costs exceeded such estimates. Inflation increased the cost of all that was accomplished and, as the membership continued its phenomenal growth, the problem of extended service grew in proportion, as illustrated in Fig. 1 (Page 28), showing dues income and total income per member compared with the cost of servicing the membership over a 10-year period.

How Dues Revision Works

Now, again, it has become apparent to the Board of Directors that some action is needed to make it possible for A.F.S. to continue without interruption, even though at reduced cost, the program which has shown such marked progress. A dues structure with an income denominator in direct ratio to necessary service expenditure provided the only solution. Consequently, on January 1, 1949, the membership dues structure will be revised, as follows:

Sustaining membership will carry minimum annual dues of $150.00.

Company membership, $65.00 annually.

Personal membership, $20.00 with exceptions: (1) individuals connected with plants holding Company or Sustaining membership, $10.00 annually; (2) individuals engaged solely in educational or domestic government work, $10.00 annually.

Student or Apprentice membership will continue to carry annual dues of $4.00.

What, specifically, has occurred to make these revisions necessary?

New A.F.S. Dues Structure

For financing a program of expanded service to the industry, the A.F.S. Board of Directors has approved the following revised dues structure, effective January 1, 1949.

Class of Membership	Current Rates	Dues on Jan. 1, 1949
SUSTAINING ..... For firms desiring to aid the Society's activities in more direct proportion to the benefits received.	$100.00 min.	$150.00 min.
COMPANY ..... Separate Company membership required for each separate plant of any one organization.	$50.00 annual	$65.00 annual
PERSONAL ..... For individuals not connected with Sustaining or Company member plants.	$15.00 annual	$20.00 annual
Exception No. 1—Individuals connected with plants holding Company or Sustaining membership.	$8.00 annual	$10.00 annual
Exception No. 2—Individuals engaged solely in educational or domestic government work.	$8.00 annual	$10.00 annual
STUDENT OR APPRENTICE Application for Student or Apprentice membership must be signed or verified by Instructor or Supervisor.	$4.00 annual	$4.00 annual

During the 7-year period 1938-39 until the 1945 increase in dues, membership in the Society increased from 3,139 to 7,815, an increase of 149 per cent. During this same period, however, the Average Dues Income per member increased from $11.21 to $14.36, an increase of only 28 per cent.

On July 1, 1945, dues of Company members were increased from $25.00 annually to $50.00, and dues of Sustaining members became $100.00 minimum annually instead of the previous minimum of $50.00. During the succeeding 12 months to July, 1946, membership increased 724, or a modest 9.2 per cent; yet, the Average Dues Income per member increased from $14.36 to $17.44, an increase of 21.4 per cent. Thus, the effect of the dues increase of 1945 seemed to have accomplished the purposes of the Board toward better financing of increasing activities.

However, since July 1, 1946, membership has continued its swift growth and in two years increased from 8,539 to 10,403, an increase of 21.8 per cent. The result of this growth has been actually to reduce the Average Dues Income per member from $17.44 on July 1, 1946, to $16.06 on July 1, 1948, a *decrease* of 8 per cent. It must be noted that this *decrease* in Average Dues Income has occurred in two years marked by greatly increased production costs of all services and supplies, multiplied by the increased cost of serving a membership over 21 per cent greater.

However, in an effort to avoid increasing dues, if possible, the Society thus far has looked to its other major sources of income, namely, advertising in AMERICAN FOUNDRYMAN, the sale of space at biennial exhibits, and the sale of publications. Each of these items has borne its share of increased operating costs.

Publications issued before and during the war years were priced in accordance with prevailing production costs. Today, those prices are far below replacement cost, and extensive text revisions, reflecting continuous advances in foundry techniques, in most cases require complete revisions of practically all publications . . . at today's tremendous cost of production.

As a result, the Society's Board of Directors has directed that a completely new publication pricing policy be put into effect at the earliest possible moment, based

A.F.S. activities increase foundry knowledge and promote fellowship among foundrymen everywhere.

on standard publishing practice, affecting the selling prices of all special publications. It is not contemplated at this time that this policy will affect continued gratis distribution of annual Preprints to members, on request, nor the prevailing policy of making the annual bound volume of TRANSACTIONS available to members on pre-publication order at minimum cost.

AMERICAN FOUNDRYMAN. In only three years of operation on its present basis, AMERICAN FOUNDRYMAN is already "in the black" with all overheads included as part of the cost of production. This phenomenal record, unique among "new publications," has been accompanied by a rate increase on January 1, 1948, justified by greatly increased circulation (membership) since advertising first was accepted on a regular basis in May 1945. A further rate increase is scheduled for January 1, 1949. Thus, it is evident that "The Foundrymen's OWN Magazine" is expected to bear its full portion of increased Society expense.

Exhibits Comprise Fifth of Revenue

Exhibits. It has long been a prevailing (and erroneous) opinion that revenue derived from the sale of exhibit space at Foundry Shows comprises the bulk of Society revenues. The fact of the matter is that the exhibits today are third in order of importance as an annual source of Society revenue. Prior to 1938-39, when exhibits were staged annually, income from these events represented 50 to 60 per cent of the Society's annual income. For the two-year period 1945-1947, gross exhibit income was only 21 per cent of total American Foundrymen's Society income.

Exhibits now are held every second year, and the net revenue from one exhibit must be spread over a period of two years as operating income. In spite of increases in the price of space and two successive splendid shows, increased costs of all exhibit services have cut deeply into anticipated net revenues.

Thus, all major sources of Society income have been fully considered already by the A.F.S. Board of Directors in its effort to finance adequately the many activities and services required for an international organization of the entire castings industry—composed of some 10,500 members all over the world, with a total of 46 Chapters at this date, and activated by some 1,000 men of the industry who are devoting time and effort of incalculable value to advance the industry they represent. The Society has a great obligation to these men; to provide, on as equitable a basis as possible, funds sufficient for them to continue their contributions to foundry knowledge and progress.

In addition, the Society's Technical Development Program fund has been drawn on to finance, in accordance with expressed obligations to the contributors to that fund, the production of special publications in foundry practice and metallurgy, and for A.F.S.-sponsored research. As a result, this special fund has been seriously depleted—again, in preference to further increasing member dues during the past three years of ever-growing inflation. This fund cannot be drawn on extensively beyond the current fiscal year without being replenished, either by the allocation of excess current operating revenues, or by additional subscriptions from industry.

TABLE 1—ALLOCATION OF EXPENSE BY ACTIVITIES
1947-48

Activity	* Per cent of Budget
Technical and Educational Activities	27.6
Convention and Exhibits	15.4
AMERICAN FOUNDRYMAN	26.2
Membership Service	6.8
Chapter and Society Administration	24.0
	100.0

* NOTE: Percentages include allocations of Staff Salaries and Overhead to all major activities.

TABLE 2—BIENNIAL INCOME AND EXPENSE
(2-Year Periods, 1937-38 to 1948-49, inclusive)

	Total Income	Total Expense	Excess Inc. or Exp.
1937-1939	$168,203	$190,371	$22,168 Exp.
1939-1941	230,011	219,544	10,497 Inc.
1941-1943	273,129	261,148	11,981 Inc.
1943-1945	375,228	343,091	32,137 Inc.
1945-1947	687,041	696,243	9,202 Exp.
1947-1949	910,069	911,537	1,468 Exp.
	$2,643,711	$2,621,934	$21,777 Inc.

Before putting the new schedule of dues into effect January 1, 1949, the membership should review the major activities of A.F.S. and thus understand the average annual cost of maintaining the work of the Society. Table 1 shows an allocation of expense by major activities. Table 2 shows total income and expenses for six 2-year periods, 1937-38 to 1947-49, inclusive (current fiscal year as budgeted). From this table it is evident that the Society has turned back into the foundry industry for the advancement of castings progress, over $2,600,000 in a 12-year period, and that the excess of American Foundrymen's Society income over expense for the period is only $21,777.

Refund 20 Per Cent to Chapters

Servicing the chapters (now totaling 39 regular and 7 student chapters) requires the constant effort of a large clerical staff. Moreover, to assist the chapters in their individual group operations, the present policy of A.F.S., to be continued after January 1, calls for a straight 20 per cent refund on all dues of members affiliated with the different group areas. This applies to all classes of membership except the Student class, which carries 100 per cent refund to the local student groups. Actually, A.F.S. serves Student memberships without charge, because the Society recognizes the value of interesting the right types of young men (students) in foundry careers.

The prime purpose of all A.F.S. activities, of course, is to coordinate and further the technical knowledge of all members and the industry generally. The expanded A.F.S. program stretches wide into the field of research, with nine major projects being undertaken at the present time:

Investigation of Effects of Metal Flow on Gating and Risering of Light Metal Castings is being conducted at Battelle Memorial Institute, Columbus, Ohio—a project of the Aluminum and Magnesium Division.

The study of *Feasibility of Centrifugally Casting Light Alloys* is underway at the Canadian Bureau of Mines, Ottawa, Canada—also sponsored on behalf of the Aluminum and Magnesium Division.

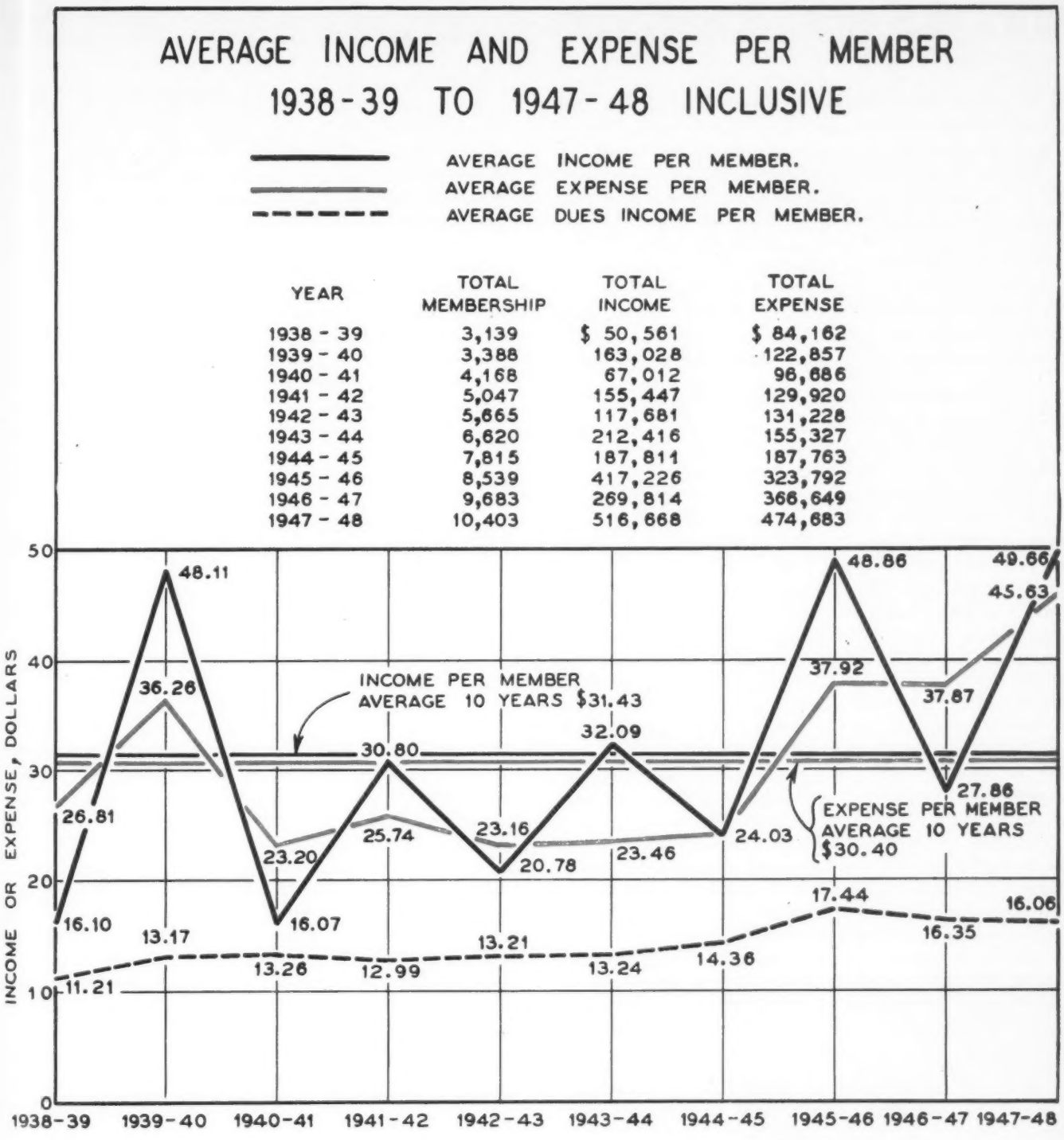


Fig. 1—Ten year summary of A.F.S. member income—expense relationship.

Studies for two divisions are being carried on at the University of Michigan, Ann Arbor, Mich. For the Brass and Bronze Division there is *The Fracture Test as an Indication of the Melt Quality of Tin Bronze;* and for the Malleable Division, *The Most Suitable Microstructure for Pearlitic Malleable Iron Castings Preparatory to Selective Hardening.*

Work for the Steel Division, on *Influence of Mold Conditions on the Development of Hot Tears in Steel Castings,* is progressing at Armour Research Foundation, Chicago.

Sand studies, on the *Properties of Sand at Elevated Temperatures,* are being continued by the Sand Division at Cornell University, Ithaca, N.Y.

With the Heat Transfer investigations at Columbia University, New York, and Cupola Research Work on *Coke Quality and Behavior in the Cupola* being undertaken as a full time research project, the American Foundrymen's Society can be justly proud of the investigational progress that is contributing so much to the advances of the industry as a whole.

Another operation of the A.F.S. educational activities is in the creation of a superior foundry library of all cast metals, so that the Society can service without delay the multitude of reference inquiries which come to A.F.S. Headquarters.

The constant production of new technical books makes it possible for A.F.S. members to develop home

and plant reference foundry libraries at minimum cost, inasmuch as members enjoy the right to obtain Society publications at appreciable discounts. This low-purchase-price privilege augments the regular distribution of technical data from National Headquarters, via AMERICAN FOUNDRYMAN and other A.F.S. publications, which are part of the regular membership service.

All A.F.S. literature is designed and circulated for the prime purpose of making it easier for the practical foundryman to do a better job for himself and his employing company. A.F.S. publications bring to the foundryman the kind of technical and practical knowledge he needs to do a better job for himself and his employing company—it is the kind of data he can apply in his everyday job, since it brings him the composite thinking of leaders of foundry thought and techniques.

Continue A.F.S. Educational Activities

A.F.S. educational activities, too, have been advanced. The Society cooperates strongly with the new Foundry Educational Foundation in pointing out to the castings industry the vital importance of interesting engineering school and college graduates in foundry careers. The Society's National Educational Program currently concerns several levels, and a major project initiated during 1947-48 involves the writing of up-to-date foundry textbooks at three separate levels: (1) engineering schools and colleges, (2) vocational and trade schools, and (3) high schools.

The importance of this project can hardly be overestimated in terms of a continuous supply of "new blood" for the castings industry. It should be emphasized to foundry management interested in education for the foundry industry that the Society's annual estimated expenditure on behalf of this work approximates $25,000.

Another outgrowth of the Educational Program has been the organization of Student chapters. To date, seven student groups are directly affiliated with A.F.S. and the regular Society chapters. Other groups now are in the process of organization.

As a further incentive to encourage apprentice training, the Society increased the prizes governing apprentice contests to $100, $50, and $25, the first, second, and third place awards in the different classes of competition. Winners are invited to attend the annual A.F.S. Convention, with A.F.S. providing transportation.

Promote Industry Good Will

The Society chapters comprised of more than 10,000 men active in improving themselves, their companies and their industry, can perform a great service in behalf of the metal castings field by stimulating good will for the foundries themselves. Several chapters have done yeoman service in this field, but much remains to be done with the active cooperation of the Society as a whole.

The Chapter Chairman Conference, annual meeting for the chairmen and vice-chairmen of all local groups, is another major activity of A.F.S. to assist the different groups in their local development programs. With the Society assuming all expense for this meeting, the Chapter Chairman Conference is designed to enable the different group leaders to exchange ideas, information, and discuss problems of mutual interest, so that all groups will function in harmony and to best advantage, and will ultimately result in a greater foundry industry. It should be realized that this single worth-while activity entails a total cost exceeding $10,000 annually.

A.F.S. Foundry Shows, held in conjunction with the annual Foundry Congress of the Society, have long performed an outstanding service to the industry. At these exhibits foundrymen have been made more conscious of the ways and means of increasing castings production, lowering the costs and improving the quality of cast structures. By improving their methods, many foundries have been able to meet the competition of substitute materials.

The technical meetings, held in conjunction with the annual A.F.S. convention, are always a means of presenting to the industry and to all those interested in metal castings the latest developments in preferred foundry procedures.

In outlining the above objectives, it should be pointed out that they are in essence the objectives that have guided A.F.S. since its formation—they are incorporated in the Society charter, drawn in 1897, ". . . to promote the arts and sciences applicable to metal castings manufacture and to improve the methods of production and the quality of castings . . ."

However, only through increased revenue can their full potentialities be developed to the point of greatest assistance to the foundry industry and the men who comprise that industry.

A.F.S. Progress to Continue

In approving the new dues structure, the A.F.S. Board of Directors has expressed complete confidence that its action would be interpreted by the membership in terms of foundry progress. Complete cooperation with the new dues structure, set up by the Society's Board of Directors, will insure an A.F.S. program that will yield a return to each individual member, by enabling the Society to carry through the projects charted for completion and others still to be undertaken with funds made available . . . projects which in themselves mean increased service to the membership through greater development of "the arts and sciences relating to the manufacture and utilization of metal castings."

These are the fundamental objects of the American Foundrymen's Society, and within these objects your Society has operated steadfastly for over 52 years. Despite lethargy, inroads and adversities, it has never deviated from this basic concept of the foundry industry's greatest need.

For over half a century—freely, reliably, without interruption—A.F.S. alone has poured back into the castings industry a flow of technical and practical knowledge that has been of incalculable value to every casting producer. In A.F.S., thousands of the foundry leaders of today have found an avenue to personal advancement and progress of their companies' interest. From all over the world, men have turned to A.F.S. with assurance of obtaining there alone the answers to their foundry problems.

This is A.F.S.—your technical Society—pledged to the ideal of Foundry Progress—a partnership in Service. Only through continued progress of a Society in step with the demands of a modern industry can such a partnership survive.

FORM SEVENTH STUDENT CHAPTER

LATEST GROUP AT TEXAS A. & M. COLLEGE

STARTED BY STUDENTS interested in modern foundry practice and in extending this interest after graduation, the Texas A. & M. Student Chapter has been formed at Texas A. & M. College, College Station, Texas, with 19 members. Approval by the A.F.S. Board of Directors makes this the seventh student chapter.

Already in operation, the new student chapter has elected the following officers to serve during the fall term: John A. Whitacre, *president;* B. D. Stone, *vice-president;* Clyde C. Spraggins, *treasurer;* Victor C. Henkell, *secretary;* and other founding members of the Texas A. & M. Student Chapter are: James A. McCulley, Teddy R. Hancock, Edward N. Baker, Monroe F. Johns, Robert T. Holmes, Shelby Ross Henson, Roy F. Knepper, Jr., Henry F. Hall, Jr., William Dallas Little, Uvalde Stoermer, William E. Way, Allen C. Garner, Charles M. Nettles, Arnold E. Baron, and John G. Dial, Jr.

Malcom J. Henley, chief metallurgist, Texas Foundries, Inc., Lufkin, is industrial advisor to the new chapter. A director of the A.F.S. Texas Chapter, he will provide a liaison between the students and industrial foundrymen. Faculty advisor is Texas A. & M. Professor Lloyd G. Berryman.

First meeting of the student chapter, according to Texas Chapter Publicity Chairman W. H. Lyne, Hughes Tool Co., Houston, was held in the engineering building at Texas A. & M. College on Oct. 12. M. W. Williams, foundry manager of Hughes Tool Co., and former chairman of the Texas Chapter spoke to professors, students, and guests on *"Opportunities in the American Foundrymen's Society and the Foundry Industry."* Enthusiasm of the students and their interest in the foundry industry was evident from the spirited question and answer session following the talk.

APPRENTICE CONTEST OPEN TILL MARCH 15

APPRENTICES IN MOLDING AND PATTERNMAKING can compete with the best in North America by entering the 1949 A.F.S. Apprentice Contest. In its 26th year, the contest is open to indentured apprentices in any shop who meet entrance requirements.

Competition is open in steel molding, gray iron molding, non-ferrous molding, and patternmaking with prizes of $100, $50, and $25 for the winners in each division. All winners receive a certificate of recognition, and in addition, the four first prize winners receive round trip rail and Pullman fare to enable them to attend the A.F.S. Annual Convention in St. Louis, May 2-5, 1949. A breakfast in honor of the winners, with A.F.S. Apprentice Contest Committee members as hosts will be held prior to awarding of prizes. Certificates and prizes will be presented by A.F.S. President W. B. Wallis at the Annual Meeting.

Official entry blanks for the 1949 A.F.S. Apprentice Contest are available from American Foundrymen's Society, 222 West Adams St., Chicago 6, Ill., or from Educational and Apprentice Committee members of A.F.S. Chapters. To enter the contest it is not necessary to be an A.F.S. member nor to be affiliated with a shop represented in the Society. Any apprentice taking a training course of not less than three years duration, who is not over 24 years of age on the day he competes in the contest, is eligible. Veterans of World War II are eligible if their age less their term of service is not over 24.

Canadian entrants should apply, through their sponsors, directly to G. Ewing Tait, Dominion Engineering Works Ltd., Box 220, Montreal, Que.

As in the past, many A.F.S. chapters will conduct local contests to select patterns and castings to be sent to St. Louis for final judging. Sponsors and entrants are urged to consult officials of the nearest A.F.S. chapter to see whether a local contest will be held before entering directly in the national contest. Plants in areas where a chapter contest will not be held may conduct a plant contest to select entrants for the finals.

Blueprints for the pattern division of the contest, and patterns for the molding divisions, are furnished by A.F.S. This year, for the first time, patterns for the same castings will be used for all three molding divisions. Castings are expected to illustrate the different types of gating and risering used for various alloys.

Last day for entering the 1949 A.F.S. Apprentice Contest is March 15. Judging will take place in St. Louis early in April. All castings and patterns entered in the finals will be exhibited during the 1949 Annual Convention of A.F.S. in St. Louis, May 2-5.

Andre Bouthillier (left) and J. Edouard Mayo (right), students at Montreal Technical School, discuss Mayo's entry in the 1948 A.F.S. Apprentice Contest with Contest Committee Chairman Roy W. Schroeder, University of Illinois, Chicago, at Convention in Philadelphia.

CANADIAN FOUNDRY CONFERENCE

Modern Foundry Methods Highlight Sessions As Dominion Chapters Meet At Montreal

FOUNDRYMEN FROM EASTERN AND CENTRAL CANADA and the Maritime provinces, and a few from the United States, attended the second All-Canadian Foundry Conference in Montreal, Que., Sept. 30 and Oct. 1. Combining a program of plant visitations and technical meetings, the Conference included papers on dust control, foundry modernization, cupola melting, brass foundry operation and molding methods, steel foundry practice, and steel sands and binders.

Climax of the Conference was the banquet attended by nearly 500 who heard A.F.S. President W. B. Wallis talk on the need for coordinating foundry research, subject of this month's editorial.

Montreal Alderman Leo McKenna referred to foundrymen as "molders of nations" in his welcoming address at luncheon following registration the morning of Sept. 30. Greetings on behalf of A.F.S. officers and directors were extended by President Wallis and by National Director E. N. Delahunt, Warden King, Ltd., Montreal. O. L. Voisard, Robert Mitchell Co. Ltd., St. Laurent, Que., chairman of the Eastern Canada & Newfoundland Chapter, presided at the luncheon and addressed the gathering in French as well as English.

Nine Plants Open For Visits

Plant visitations were an important part of the Conference program and transportation was provided to plants the afternoon of the first and the morning of the second day. Plants open and operations viewed were: Jenkins Bros. Ltd., bronze valve production; Dominion Engineering Works, Ltd., cast iron jobbing; Crane Ltd., brass and malleable foundries; Robert Mitchell Ltd., light metals; LaSalle Coke Co., coke manufacture; Canadian Car & Foundry Co. Ltd., steel; Canadian National Railways Foundry, cast iron production; Warden King, Ltd., cast iron production; Montreal Bronze Ltd., bronze foundry.

Dr. Allen D. Brandt, Bethlehem Steel Co., Bethlehem, Pa., gave an outline of the sources of dust and data on air flow needed to remove it in his talk *"Dust Control in the Foundry."* A feature of the Conference, the talk was scheduled for the evening of Sept. 30.

Foundry processes may be divided into five groups in discussing dust control, Dr. Brandt explained. These are: preparation of molds and cores; melting and pouring; shakeout and core removal; cleaning; and reconditioning molding sand.

Very little dust is dispersed in handling damp sand, most of the dust found in molding areas being due to poor housekeeping, he said. Core making produces less dust than molding although spraying operations may constitute a serious dust hazard if not controlled. Local exhaust hoods, and lateral or down-draft ventilation were suggested as remedies by Dr. Brandt.

Stresses Good Housekeeping

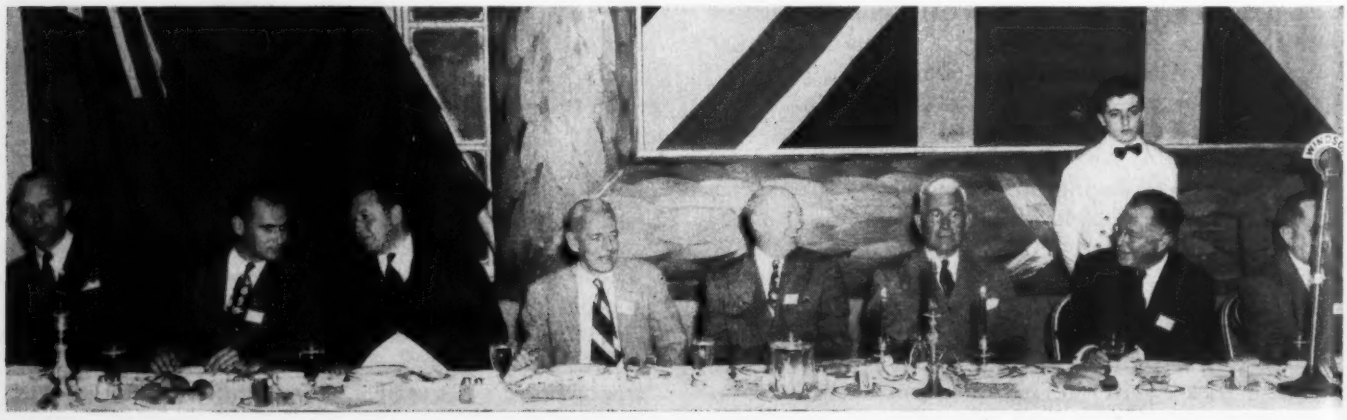
Good housekeeping was again emphasized by the speaker in pointing out that melting and pouring do not in themselves create a dust problem. However, related activity frequently stirs up dust. Remedies suggested included wetting the floor with water containing a suitable wetting agent, good ventilation in the pouring area, and local exhaust ventilation at pouring stations and near furnaces.

Dust produced by cutting refractories with an abrasive wheel and from ladle and furnace lining operations, should be removed by exhaust equipment.

Core knockout operations are dustier than mold shakeouts, according to Dr. Brandt, but dust control in both cases calls for allowing castings to cool in the sand as long as possible, wetting down the floor and molds before shaking out, wetting the sand immediately afterward, and handling castings, bottom boards, and flasks carefully. Dust control in a mechanized foundry is easier than in a jobbing foundry, he said. For cores hard to remove, the operation should be done in a special exhaust ventilated chamber by workers wearing supplied-air respirators.

While cleaning operations produce considerable dust they lend themselves very well to dust control by

Canadian industrial leaders sat with A.F.S. officers at the All-Canadian Foundry Conference banquet.



Transportation to and from Montreal area plants open for inspection was provided for Conference attendants.

local exhaust ventilation and as a result, Dr. Brandt pointed out, dust concentrations in the average foundry cleaning room are not high. The most difficult dust control problem is associated with chipping sand from large and irregularly shaped castings.

Sand conditioning in which damp sand is handled produces no serious dust hazard and where dry sand is involved the control of dust is relatively simple. This is done by means of local exhaust hoods and enclosed conveyor belts and equipment.

Good general ventilation is important because all foundries have minor and scattered dust sources in addition to the major ones which may be under control, Dr. Brandt concluded.

Other technical talks were grouped according to interest in steel, gray iron, and non-ferrous. Presented simultaneously the afternoon of Oct. 1, the sessions were well attended and the papers were followed by extensive discussion. Speakers at the steel session were Turney Shute, Canadian Car & Foundry Co. Ltd., Montreal, who talked on *"Steel Molding Sands and Binders"* and National Director V. E. Zang, Unitcast Corp., Toledo, Ohio, and Sherbrooke, Que., who spoke on *"General Steel Foundry Procedure."* Presiding were H. H. Fairfield, Wm. Kennedy & Sons, Ltd., Owen Sound, Ont., and C. V. Hacker, Lynn McLeod Metallurgy, Ltd., Thetford Mines, Que.

Describes Steel Molding Sand Properties

Grain size, distribution, grain type, and composition are the important characteristics of steel molding sands, Mr. Shute said, in pointing out that sand properties were not so well defined as are properties of other materials. In the evaluation of binders, the important property is toughness, a combination of strength and "ductility." He classified binders as inorganic, organic, and potential binders. The first are clays and bentonites; the second are cereals, molasses, oils, resins, lignin, pitch, and plastics. Potentials named were silica flour, silt, reclaim fines, iron oxide, wood flour, and water.

As the temperature increases the inorganic binders increase in strength. Organic binders generally burn out around 600 F which enables them to provide green strength without hot strength. While inorganic binders give strength with brittleness, the organic binders provide toughness according to Mr. Shute. The potential binders behave as binders under certain circumstances, especially at high temperatures.

In preparing a steel molding sand, Mr. Shute said the following factors should be considered: milling cycle, moisture, ramming, permeability, casting size and shape, gating, pouring temperature, metal composition, mold coating, and time factors such as age of mold and age of metal.

Following a discussion of casting defects due to sand, the meeting was opened for questions. Penetration and cement bonded molds were discussed from the floor at considerable length.

Outlines Steel Foundry Procedure

Typical small castings production on a jobbing basis was described in Mr. Zang's talk, *"General Steel Foundry Procedure."* When castings are ordered, he said, it is first necessary to determine if they can be produced and whether delivery requirements can be met. Then a model is made and any changes desired are taken up with the customer. Gating and rigging are considered next, as well as molding methods.

Following production of sample castings, radiographic examination and dimensional accuracy checks are made. Samples are sent to the customer, following inspection, and the buyer may be asked to approve one casting and return it to the foundry for future reference in case of question or dispute.

In describing Unitcast operations, Mr. Zang explained that core breakage is avoided by air-blast cooling of the cores at the vertical ovens. Sand control, including regular dilatometer tests on cores, calls for checking every batch of facing and heap sand in the bins. By baking test cores in vertical ovens both core mixtures and oven operations are checked.

Mold shifts which may result when molds pass from one roll of a conveyor to another are eliminated at Unitcast by moving the molds on pallets with wheels which run on rails set in the floor. Pouring operations are standard with metal coming from the electric furnaces at a minimum of 3200 F and being transported in 300 lb ladles.

After the shakeout, castings are blasted and inspected. Small castings are ground individually in closed, exhausted booths, or held in groups by jigs and ground with swing frame grinders also enclosed. Castings are segregated by analysis and by size prior to heat treatment. Hot or cold pressing in dies is practiced where high dimensional accuracy is required. Mr. Zang felt this phase of production might have to be expanded to compete with other types of castings.

I. C. Sheppard, Beach Foundry Ltd., Ottawa, Ont., spoke on *"Modernization in the Foundry"* and E. C. Winsborrow, Shawinigan Foundries Ltd., Shawinigan

Steel meeting, left to right, Technical Chairman C. V. Hacker, Lynn McLeod Metallurgy Ltd., V. E. Zang, Unitcast Corp., a speaker, and Technical Chairman H. H. Fairfield, William Kennedy & Sons.

Falls, Que., gave a paper entitled *"Cupola Melting"* at the cast iron group meeting. C. Johnston, E. Long Ltd., Orillia, Ont., and J. Grieve, Dominion Engineering Works, Ltd., Montreal, presided.

Modernization and mechanization are two different things, Mr. Sheppard said, pointing out that modernizing a foundry requires bringing and keeping a plant and its personnel up to date. Mechanizing involves addition of equipment. Mechanical equipment is not a cure-all, he warned, stating that intelligent application and operation are required to get the maximum benefit from machinery. Foundrymen should make best use of what they have before changing, he said.

Promotion Within Foundry Urged

Mr. Sheppard suggested looking for supervisors in one's own organization, and for trained workers he urged organizing an apprenticeship course. Plant layout as well as personnel needs modernizing in many foundries, he said. Mr. Sheppard urged foundry management to pay particular attention to materials handling which requires 22 percent of all labor.

A third consideration in modernizing a foundry is the comfort and health of the employees. Modern shower and sanitary facilities and up to date locker rooms are essential, said Mr. Sheppard. Good lighting and good housekeeping are recommended.

Control of operations was the speaker's fourth item of foundry modernization. A well-designed, overall production plan properly executed will free a staff of a mass of unnecessary detail, Mr. Sheppard said. Chemical analyses, chill tests, and temperature measurements are some of the foundry controls essential to meeting present day specifications.

Cost control is most significant and indicates the success of operations, according to the speaker.

Mr. Sheppard illustrated a number of modernization problems by reference to his plant. He described the use of a 3 ton electric furnace for continuous melting of loose cast iron borings. When metal requirements rose to 45 tons this was achieved by melting at night the full holding capacity of 11 tons. After the first morning tap, a cupola was started and metal transferred continuously to the electric furnace thus providing a constant supply of metal and requiring a minimum of power for temperature control.

So-called imponderables of cupola practice are results of incorrect diagnosis of fundamental features, Mr. Winsborrow said, in his talk *"Cupola Melting,"* which concluded the gray iron session. He decried the operation of cupolas without accurate weighing of charges and control of blast. Not sufficient attention is paid to weight of air which, the speaker pointed out, is in excess of the weight of metal melted.

Devoting most of his talk to heat development and heat transfer, Mr. Winsborrow explained that a good grade of coke is potentially able to melt about 21 lb of iron and raise it to a temperature of about 2700 F. This is not achieved in practice because of heat losses through radiation, slag, and gases, and because of the endothermic reaction in the upper part of the bed. Referring to this zone as the protective zone, he pointed out that silicon and manganese losses would be much higher if coke were not present to react with the carbon dioxide present.

Warning against drastic coke economy, Mr. Winsborrow discussed the relation between stage of combustion and oxidation losses, and described control apparatus used in controlling stage of combustion.

Dr. Allen D. Brandt, Bethlehem Steel Co., spoke on foundry dust control at the first technical meeting.

Factors affecting heat transfer in the cupola, outlined by Mr. Winsborrow, were: size of coke; size of pieces of metal; velocity of gases; air distribution as influenced by tuyere location and design; and formation and elimination of slag. Warning against charging material of extremely small size, he suggested that optimum coke size is 10 per cent of the cupola diameter. Formation and elimination of slag of proper viscosity and composition is important, he said, stating that it takes as much heat to produce a pound of slag as to melt a pound of metal.

Mr. Winsborrow concluded his talk by urging appraisal of cupola capacity in terms of fuel burning rate rather than melting rate. He suggested a figure of 150 to 160 lb coke burned per square foot of cupola cross section.

Non-ferrous session papers were *"Modern Methods of Brass Foundry Operation,"* by J. C. Converse, Crane Ltd., and *"Molding Methods,"* by H. W. Bennett, Dominion Engineering Works, Ltd. Technical chair-

men were J. Dalby, Wilson Brass & Aluminum Foundries, Ltd., and H. J. Roast, consultant, Montreal.

Foundry operation and performance rest in the hands of individuals, though mechanization is an important factor, said Mr. Converse. Tracing the development of modern foundry practice, he stated that the difference between the foundry of yesterday and the modern foundry is that today "The Foundry is a Good Place to Work."

Use of a continuous conveyor in a brass foundry is complicated by the variety of alloys poured and because the heavy and light castings require considerably different pouring temperatures. Usually the continuous conveyor cannot be used unless the castings are very similar and of the same alloy, Mr. Converse said. The small turntable mold conveyor is not favored because of the long cooling period required after pouring. A straight line conveyor, longer than would be used for iron, is preferred.

Modern brass foundry practice calls for melting with gas, oil or electricity which provide closer control than slow melting coke fired pit furnaces. Sand is mixed mechanically in the modern foundry, said Mr. Converse, and he recommended use of aerators, magnetic separators, and sand hoppers. All raw materials must be bought to specification, checked when received, and controlled when used.

Gating Alterations Too Frequent

Noting that some foundries frequently change the gating systems of castings, the speaker recommended establishing a rule against gate alterations except on high authority if a casting has run a year with a satisfactory record. Constant checking is required in modern foundry practice, Mr. Converse said, in outlining a plan for scrap reduction before, rather than after, a job is run. He suggested referring to records for main causes of scrap on a given casting and reminding the supervisors of these causes just before the job is run. Reminders are to be made up in the form of telegrams.

While scrap reduction is a major factor in good modern foundry operation, it is not the controlling factor. Costs must be considered, said Mr. Converse, and he suggested that on some jobs it may be more economical to run five per cent scrap than to run no scrap at all. Recommending a weekly scrap meeting of foundry supervisors, he emphasized a positive approach—the number of good castings. This brings production as well as scrap reduction into the picture.

Mr. Converse concluded with a recommendation to schedule production by tonnage as well as by piece thus avoiding high and low scrap days which frequently correlate closely with low and high tonnage days.

In his paper, *"Molding Methods,"* Mr. Bennett described and illustrated an unusual technique used to cast 150 lb bronze pilot models of hydro-turbine runners. Because the casting is used in determining turbine characteristics it must be dimensionally accurate. Welding of defects is not permitted because it distorts the vanes which are about $\frac{3}{8}$ in. at the heaviest cross section and taper down to less than $\frac{1}{8}$ in.

Describing the technique soon to be shown in American Foundryman, Mr. Bennett told how the runner is molded in a two part flask with the vanes cast in cores. In order to fit the last two intricately shaped cores into the mold cavity it is necessary to separate the drag across a diagonal and on a vertical plane. This is accomplished by keeping the two halves of the drag separated during ramming by light sheet metal which divides the pattern and the drag and is held in place at the corners where the drag is bolted.

The mold rests on a machined iron plate; the top and bottom flanges of the flask are also machined. This enables the molder to slide the two halves of the drag apart easily for removal of the sheet and placing of the vane cores. These cores are made of fine open sand with high permeability but which does not permit penetration of the hot metal used to pour the casting. Strength and high collapsibility are essential and the cores must be dimensionally accurate to better than $\frac{1}{64}$ in. They must also be positioned correctly within this small dimension.

Prior to placing the cope core the mold is carefully checked. Adjustment in vane thickness is made by placing small metal plates between the core prints.

Mr. Bennett explained the handling of other molding problems in which a choice had to be made between several alternative methods of gating and risering. He recommended a reversed horn gate for metals such as aluminum or manganese bronze which must enter the mold cavity quietly to minimize dross formation and entrapment.

Considerable discussion from the floor was aroused by Mr. Bennett's explanation of the casting of bushings, controversy arising between proponents of vertical and horizontal molding. The speaker brought out the false economy of using a stock bushing pattern to make an odd size casting, thus requiring extra machining and entailing the risk of losing castings by machining below the pressure-tight outer surfaces into possible porous areas.

Acknowledged a great success by all who attended, the second All-Canadian Foundry Conference was under the general direction of James H. Newman, Newman Foundry Supply Ltd., Montreal, who is vice-chairman of the Eastern Canada & Newfoundland Chapter and was chairman of the Conference Organizing Committee. Other members of this committee were Henry Louette, Warden King, Ltd., and M. A. Hughes, LaSalle Coke Co., Montreal. The Program Committee consisted of A. H. Lewis, Dominion Engi-

The registration table was a favorite meeting place for those not in a technical session or visiting a plant.

J. C. Converse, Crane Ltd., describing modern brass foundry operation at the non-ferrous session. Seated are Technical Chairmen H. J. Roast (left) and J. Dalby, Wilson Brass & Aluminum Foundries, Ltd., (right).

neering Works, Ltd., *chairman;* J. W. Birks, Crane Ltd.; C. Bourassa, Werner G. Smith, Ltd. Montreal; J. W. Dick, Montreal Bronze Co. Ltd., A. H. Thomson, Canadian Refractories Co., Ltd., Montreal; and R. Thomson, Canadian Car & Foundry Co.

J. H. Archambault, LaSalle Coke Co., chairman of the Housing Committee, was assisted by Colin B. Sewell, LaSalle Builders Supply Ltd., and R. L. Guilmette, La Cie J. A. Gosselin Ltd., Drummondsville.

Heading the Plant Visitations was G. W. Patterson, Refractories Engineering & Supplies Ltd. Members included W. P. Sullivan, Warden King, Ltd.; John S. Bennett, J. Grieve, Dominion Engineering Works, Ltd., William Tibbits, Canadian Car & Foundry Co., Ltd.

The Publicity Committee was made up of Chairman Robert E. Cameron, Webster & Sons Ltd.; Cecil Rowe, Crane Ltd.; H. T. Doran, Whiting Corp. (Canada) Ltd.; L. Beaudry, Warden King, Ltd.; Harry E. Francis, Jenkins Bros. Ltd.; M. McQuiggan, Canadian Foundry Supply & Equipment Ltd.; and G. Ewing Tait, Dominion Engineering Works, Ltd.

Cecil Rowe, Crane Ltd., was chairman of the Entertainment Committee. Members were B. Campbell, Warden King, Ltd.; E. Clark, Dominion Engineering Works, Ltd.; Harry E. Francis, Jenkins Bros. Ltd.; L. Guilmette and M. McQuiggan, Canadian Foundry Supply & Equipment Ltd.; J. MacCallum and P. von Colditz, Canadian Car & Foundry Co. Ltd.; A. J. Moore, Montreal Bronze Ltd.; H. Robb, Newman Foundry Supply Ltd.; Wm. Sharkey, Robert Mitchell Co. Ltd.; and P. Savoie, Webster & Sons Ltd.

The Reception Committee, headed by Harry E. Francis, Jenkins Bros. Ltd., was comprised of Robert Stott, Canadian Car & Foundry Co., Ltd.; William J. Brown, Robert W. Bartram Ltd.; C. Bourassa, Werner G. Smith Ltd., Montreal; Jack H. King, Werner G. Smith Ltd., Toronto, Ont.; and Don Barnes, Don Barnes Foundry Supplies & Equipment, Hamilton, Ont.

Registration was under the direction of L. Guilmette, Canadian Foundry Supply & Equipment Ltd., and John G. Hunt, Dominion Engineering Works, Ltd.

FEF Announces Addition Of NFFS, Lists Minimum High School Course

INCLUSION OF THE NON-FERROUS FOUNDERS SOCIETY among the founding members of the Foundry Educational Foundation, and high school preparation required for entrance into engineering colleges are the subjects of recent FEF bulletins.

Following an invitation extended by Foundation President Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, Ohio, the Non-Ferrous Founders Society joined FEF as a founding member on August 8. Trustees named to act with the Foundation in behalf of the Society are: G. B. Hazen, Brass Foundry Co., Peoria, Ill., and W. B. Wilkins, American Manganese Bronze Co., Philadelphia.

By amendment to the FEF Code of Regulations, the Foundation's Board is empowered to add other founding members. Thus, the way is open for other qualified societies to become founding members of FEF.

University entrance requirements vary from school to school, an FEF bulletin states, and engineering colleges usually have a stiffer set of qualifications for the high school graduate to meet than is required for other courses of study. Several foundry program applicants at the Foundation's six engineering schools are taking summer courses, and in one case a complete additional year of high school work, to qualify for entrance.

The Foundation suggests that foundry executives and supervisors counsel candidates who are now in high school concerning engineering requirements. The FEF recommends that the requirements of the particular college which the student desires to enter be investigated and the student's course of study be planned to meet them.

As an example, the Foundation presents the following list of credits as an adequate program which will meet the requirements of almost every engineering school in the country:

English, three years; Algebra, two years; Plane Geometry, one year; Solid Geometry, one semester; Physics, one year; Trigonometry, one year; Language or History, two years; and Chemistry, one year.

Review Malleable Iron Research Under Direction Of A.F.S. Committee

HEAT PENETRATION or "case depth" of 0.060 in. is the standard set by the Malleable Iron Research Committee which met Oct. 5 in the Michigan Union, University of Michigan. Other decisions reached at this meeting include a plan to flame harden and induction harden specimens in industrial firms and continuance of flame hardening at the University. Macro-etching techniques and hardness testing were discussed.

The work on surface hardening of malleable iron is being carried out on test specimens from eight commercial foundries.

Present were C. F. Joseph, Central Foundry Div., General Motors Corp., Saginaw, Mich., *chairman;* H. Bornstein, Deere & Co., Moline, Ill.; Milton Tilley, National Malleable & Steel Castings Co., Cleveland; W. A. Kennedy, Grinnell Co., Inc., Providence, R.I.; Prof. R. Schneidewind, Prof. F. B. Rote, Prof. W. P. Wood, S. H. Bush, research fellow on the project, and Jos. E. Foster, A.F.S. Headquarters.

MICHIGAN STATE HOST TO REGIONAL MEETING

Sponsored by Four A.F.S. Chapters

A.F.S. National Director Frank C. Riecks, manager of foundries, Ford Motor Co., makes a running commentary on a film showing cylinder block casting.

NEW DEVELOPMENTS IN THE FOUNDRY INDUSTRY and discussion of today's casting problems keynoted the Annual Michigan Regional Foundry Conference, held on the campus of Michigan State College October 1 and 2. The Conference was under the auspices of the College's Department of Mechanical Engineering and the four Michigan chapters of the American Foundrymen's Society.

Opening the Conference, Prof. C. C. Sigerfoos, chairman of the Central Michigan Chapter, welcomed more than 150 foundrymen from all over the state on behalf of the College, and introduced Karl H. McDonel, secretary of the Michigan Board of Agriculture, who outlined the history of Michigan State College, its current courses of study and its plans for expansion.

Stanley Davis, supervisor of Campbell, Wyant & Cannon Foundry's sand control laboratory, opened the first technical session by introducing A.F.S. National Director F. C. Riecks, manager of foundries, Ford Motor Co., Dearborn, Mich., who presented a film, *"Making Cylinder Block Castings in the Rouge Production Foundry."* The careful planning and ingenuity of Ford foundrymen and engineers were apparent in the smooth-flowing, efficient production of complex motor block castings as illustrated by the film.

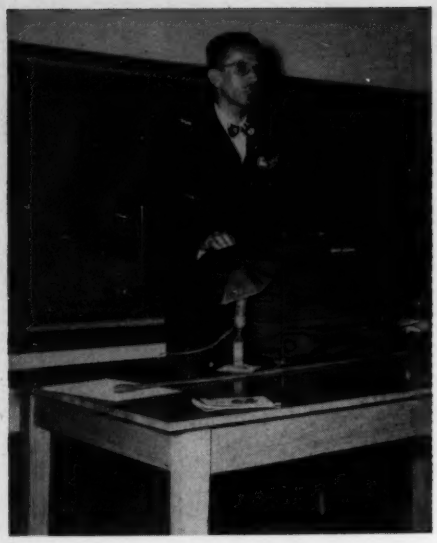
Mr. Riecks stated that the film was part of a multimillion dollar plan of educational work embarked upon by the Ford Motor Co. following the war. This was the first showing of the film and the sound track had not yet been added, consequently, Mr. Riecks provided a running commentary on the many intricate operations shown.

It was evident from many of the scenes of the Rouge Plant that mechanization has been in progress there for some time and that excellent working conditions prevail. Particularly noteworthy is the large allotment of working space to each employee, preventing worker to worker interference.

Discussing mold and core wash materials, following the film, Dr. J. A. Ridderhoff, manager of the foundry facings department, F. B. Stevens, Inc., Detroit, stated that the term "mold wash" is a misnomer and should be "mold coating." Mold coatings, Dr. Ridderhoff said, are used to produce better surfaces on castings than can be otherwise obtained. The depth of wash, he added, should be between five and seven sand grains.

There are two types of washes—graphite base and refractory base—Dr. Ridderhoff stated. The graphite-base washes form an insulation between the molten

A.F.S. National Vice President Edwin W. Horlebein rises to address the October 1 evening session of the Conference, held at Hunt's Food Shop, East Lansing. Looking on are, left, Joseph E. Foster, A.F.S. Technical Assistant, and Dean L. G. Miller of Michigan State College's School of Engineering, who presided at the session. Daytime technical sessions of the Conference were held in the R. E. Olds Hall of Engineering at Michigan State.



Left: Dr. J. A. Ridderhoff, manager of the foundry facings department of Frederick B. Stevens, Inc., Detroit, discussing the various types of mold and core washes, their uses, and proper methods of mixing and proper Baumé values for washes.

Harry E. Gravlin, Ford Motor Co., Dearborn, Mich., uses a Michigan State College classroom blackboard to analyze defects in several castings which he exhibited. Mr. Gravlin urged his audience to contribute their criticisms of defects shown.

metal and the mold sand grains—preventing metal and sand fusion. The refractory-base washes resist fusion and metal penetration. Dr. Ridderhoff concluded with a discussion of the proper mixing of washes and of Baumé values of washes for dipping, brushing and spraying.

R. B. Melmoth, metallurgical engineer, Ford Motor Co., Dearborn, continued on the same subject with a discussion on the preparation and application of core washes. Mr. Melmoth stressed the importance of exercising caution in avoiding air entrapment during mixing of washes. Care should be taken in conveying core washes through pipes to see that the wash is not violently agitated in transit, he said.

In outlining the preparation of core washes, Mr. Melmoth listed the advantages and disadvantages of the various available preparations.

Following luncheon in Phillips Residence Hall, the Conference resumed its activities in the R. E. Olds Hall of Engineering, when A.F.S. National Vice-President Edwin W. Horlebein spoke on the proposed activities of the American Foundrymen's Society for 1949.

Technical Chairman O. E. Sundstedt, General Foundry and Manufacturing Co., chairman of the Saginaw Valley Chapter, introduced the first technical speaker of the afternoon session, Joseph Gitzen, president, Delta Oil Products Co., Milwaukee, Wis.

Speaking on *"Physical, Mechanical and Foundry Core Binders,"* Mr. Gitzen differentiated between the two types of core binders—organic, such as cereal, corn flour, dextrine, linseed and similar oils—and inorganic, such as bentonite, oxides, silica flour, plastics, and fireclay. Organic binders, he said, decompose on contact with molten metal, liberating carbon, hydrogen and oxygen. Inorganic binders do not decompose on contact and do not liberate gases. Organic binders, Mr. Gitzen stated, impart green strength to the mold, whereas inorganic binders impart hot strength.

The second speaker, K. H. Priestley of Vassar Electroloy Products, Inc., in his address, *"Gray Iron Metallurgy and Foundry Practice,"* discussed such subjects as the fundamental effects of various elements on properties of gray iron, carbon equivalent, metal solidification, inoculation of melt, foundry controls of raw materials, melting, chill control, fracture test and metallographic control. Mr. Priestley showed an example of a 3/8 in. chill in automotive and truck tappets to illustrate the degree of chill control that can be attained.

C. K. Donoho of the American Cast Iron Pipe Co., Birmingham, Ala., in his discussion of *"Magnesium Treated Nodular Graphite Cast Irons"* said that he had produced nodular graphite cast iron by the addition to the ladle of less than one per cent magnesium in pure or alloyed form. The iron used had approximately eutectic composition and contained 0.60 per cent phosphorus and 0.04 per cent sulphur.

The concluding speaker of the first afternoon's session, R. L. McIlvaine, National Engineering Co., Chicago, illustrated his talk on *"Foundry Layouts"* with slides showing modern foundry installations. Mr. McIlvaine stressed simplicity in foundry design and stated that before embarking on a plan of foundry modernization it is necessary to determine whether the major purpose of the modernization plan is to increase production, improve product quality or to improve working conditions.

During the non-technical evening session at Hunt's Food Shop in East Lansing, Russell E. Horwood, associate professor of Dairy at Michigan State College, related his recent experiences in Japan, where he studied agricultural methods and living conditions for a year. Mr. Horwood's talk was illustrated with natural color slides depicting Japanese life.

Dinner chairman was Dean L. G. Miller of the School of Engineering, with A.F.S. National Vice-President Edwin W. Horlebein as guest of honor.

Opening the October 2 technical session in R. E. Olds Hall of Engineering, Detroit Chapter Chairman A. W. Stolzenburg, Aluminum Company of America, Detroit, introduced George Tubich, district engineer, Michigan Department of Health, who spoke on *"Attracting and Keeping Good Men in Your Foundry."*

Mr. Tubich stressed good housekeeping and the extensive use of exhaust blowers as an absolute necessity in lowering the rapid turnover of foundry manpower. Some of Mr. Tubich's statistics on dust content of foundry air were questioned by the audience.

The final session of the Conference featured a discussion on *"Sand, Metal or Men?"*, led by Harry E. Gravlin, Ford Motor Co., Dearborn, who displayed a number of defective castings and asked the audience to help analyze the possible causes of the defects.

1949 Convention To Hear Report On Fracture Test For Tin Bronze

CHANGE TO A STEP BAR type of fracture specimen was recommended at the Oct. 4 meeting of the Brass and Bronze Research Committee at the Michigan Union, University of Michigan, Ann Arbor. Meeting to discuss progress on the A.F.S.-sponsored project, "Fracture Test for Quality Evaluation of Tin Bronze," committee members decided to change from a test bar of uniform section, discussed melting at different temperatures, and decided to melt under four atmospheres—oxidizing, neutral, reducing, and the atmosphere of an induction furnace. Color photographs of the fractures are made as part of the record of test data.

The committee plans to present a report on the research project at the A.F.S. Convention in St. Louis, May 2-5, 1949.

Present at the Oct. 4 meeting were Dr. Blake Loring, Naval Research Laboratory, Washington, D.C., chairman; Geo. P. Halliwell, H. Kramer & Co., vice-chairman of the A.F.S. Brass and Bronze Division; G. J. LeBrasse, Federal Mogul Corp., Ann Arbor, Mich.; Prof. F. B. Rote; Prof. C. Upthegrove; John Ewing, research fellow carrying out the project; and Jos. E. Foster, A.F.S. Headquarters. Committee members unable to attend were Dr. A. J. Smith, formerly with Lunkenheimer Corp., Cincinnati, and now a faculty member at Michigan State College, East Lansing, Mich.; R. M. Brick, University of Pennsylvania, Philadelphia; and C. A. Robeck, Gibson & Kirk Co., Baltimore.

Tech Talk Outlines Help Committee Plan Convention Pattern Sessions

SPEAKERS FOR THE 1949 A.F.S. CONVENTION attended the meeting of the Pattern Division Executive Committee at Society Headquarters Oct. 8 to outline their papers and hear comments of committee members.

Three papers have been scheduled by Program and Papers Committee Chairman L. F. Tucker, City Pattern & Foundry Co., South Bend, Ind. Papers and authors for the technical session are: *"Information Required to Produce Satisfactory Pattern Equipment,"* by R. J. Christensen, Wisconsin Pattern Works, Inc., Racine, Wis., and *"Maintenance of Wood and Metal Pattern Equipment,"* by A. Huebner, Allis-Chalmers Mfg. Co., West Allis, Wis. Vaughan C. Reid, Jr., City Pattern Foundry and Machine Co., Detroit, will lead the discussion, "Shall Pattern Equipment Be Machined or Cast to Size?" at the Pattern Round Table Luncheon.

In opening the meeting, Division Chairman A. F. Pfeiffer, Allis-Chalmers Mfg. Co., outlined tests on plastics and plastic patterns made by several cooperating pattern shops. The tests are being studied for possible publication in AMERICAN FOUNDRYMAN.

Standard pattern colors were discussed, additional speakers on pattern subjects for the A.F.S. Chapter Speakers List were considered, and a reorganization of the Patternmaking Machinery and Methods Committee was recommended. Members also heard a resume of the Pattern Manual Committee meeting of Sept. 27.

In addition to those mentioned, the following attended the meeting: J. W. Costello, American Hoist & Derrick Co., St. Paul, Minn.; National Director J. E. Kolb, Caterpillar Tractor Co., Peoria, Ill.; G. E. Garvey, City Pattern & Foundry Co., South Bend, Ind.; M. Rintz, Continental Foundry & Machine Co., East Chicago, Ind.; V. J. Sedlon, Master Pattern Co., Cleveland; A. H. Stenzel, Stenzel Pattern Works, Houston, Texas; W. G. Schuller, Caterpillar Tractor Co.; H. K. Swanson, Swanson Pattern & Model Works, East Chicago, Ind.; and A.F.S. Technical Director S. C. Massari. G. J. Gedeon, Aluminum Company of America and E. T. Kindt, Kindt-Collins Co., both of Cleveland, were not able to attend.

Outline Proposed Pattern Manual

MEETING TO DISCUSS the proposed A.F.S. Pattern Manual, members of the Pattern Manual Committee held a conference at A.F.S. Headquarters Sept. 27. An outline for the Manual was prepared and authors for the various chapters were chosen. Detailed chapter outlines are to be prepared by the authors for approval by the Committee.

Assignments for the preparation of chapters made by Committee Chairman H. K. Swanson, Swanson Pattern & Model Works, East Chicago, Ind., are:

"How to Select Pattern Equipment," L. J. Gratz, G. & O. Pattern Works, Milwaukee.

"Wood Pattern Construction," H. K. Swanson.

"Metal Pattern Construction," G. W. Schuller, Caterpillar Tractor Co., Peoria, Ill.

"Plastic Pattern Construction," Ladd Salach, Plastic Corporation of Chicago.

"Plaster Pattern Construction," E. H. Schleede, U. S. Gypsum Co., Chicago.

"Core Boxes—Wood," A. Huebner, Allis-Chalmers Mfg. Co., West Allis, Wis.

"Core Boxes—Metal," H. J. Jacobson, Industrial Pattern Works, Chicago.

"Core Boxes—Blowing," Z. Madacey, Caterpillar Tractor Co., Peoria, Ill.

"Core Boxes—Plastic," Ladd Salach.

"Pattern Finishes," E. T. Kindt, Kindt-Collins Co., Cleveland.

At the meeting of the Pattern Manual Committee were: Chairman Swanson, Messrs. Gratz and Huebner, W. A. Balton, Link Belt Co., Chicago, and S. C. Massari, A.F.S. technical director. Mr. Schuller and E. J. McAfee, Puget Sound Naval Shipyard, Bremerton, Wash., could not attend.

Recent Committee Personnel Changes

HIRAM BROWN, Solar Aircraft Co., Des Moines, Iowa, is vice-chairman of the Aluminum and Magnesium Division and chairman of the Division's Program and Papers Committee. He replaces Manley E. Brooks who left Dow Chemical Co., Midland, Mich., to act as advisor on magnesium foundry operation for Magnesium Alloy Products Co., Compton, Calif.

New Refractories Committee chairman is A. S. Klopf, Western Foundry Co., Chicago, who has been a member of the committee for a number of years. R. H. Stone, Vesuvius Crucible Co., former chairman, will remain on the committee.

Frank C. Cech, Cleveland Trade School, Cleveland, has withdrawn from the Executive Committees of the Pattern Division and of the Educational Division. He will maintain contact with A.F.S. activities by joining the Educational Division Advisory Group.

USING STRUCTURE DIAGRAMS IN GRAY IRON FOUNDRIES

Sven H. Torreson
Foundry Manager
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CAST IRON having certain predetermined mechanical properties, when no so-called alloy iron is involved, is obtained substantially by proper balancing of the carbon and silicon contents in relation to one another and in relation to the cooling rate of the metal, i.e., to the shape and dimensions of the casting.

The most suitable carbon and silicon contents usually are based on our own experience or own trial heats. But perhaps just as often the data are taken from tables and structure diagrams drawn up from tests carried out under conditions more or less similar to one's own. To some extent diagrams are more or less pure theoretical speculations, which can be very well grounded scientificially, but nevertheless may be unreliable in practice. It is well known, for example, that the raw materials, melting method, slag removal, degree of superheating, inoculation, etc., can have considerable influence on the structure and properties.

By changing the raw material, for example, the pig iron, scrap, coke, etc., an entirely different carbon content will be obtained in the iron. How, then, should the silicon content be modified? The relation between carbon and silicon contents is clear and well understood; it is known that a lower carbon content requires a higher silicon content, and vice versa, a higher carbon content requires a lower silicon content.

Determine C:Si Ratio

The problems of choosing the proper carbon or silicon percentage, or how much the silicon content should be increased or decreased with the unavoidable changing of the carbon content are not easily solved. One man believes he has found the answer in the Maurer diagram; another man sees the solution in the Osann modification of this diagram, and a third figures his silicon content with the "saturation degree formula."

Common to all of these is the fact that the relation between carbon and silicon must be considered; the difference is in the opinions regarding the degree of influence of the silicon. In other words, it is considered that the sum of the carbon and a constant "X" of the silicon content can be used as the basis for calculating the iron mixtures. Thus, according to the Maurer diagram, to get a so-called pearlitic structure it is necessary to consider that one part of silicon has approximately the same value or effect as one part of carbon. Osann likens two parts of silicon to one of carbon, and with "saturation degree formula" three parts of silicon are equivalent to approximately one part of carbon.

It is clear that silicon can not replace carbon under all conditions. For example, if it is attempted, by means of silicon, to keep the graphite content constant in two kinds of cast iron with different total carbon content, then the combined carbon will differ; if it is desired to keep the combined carbon constant, the graphite content must vary. But, by a proper combination of carbon and silicon, it should be possible to predetermine a certain structure, tensile strength, modulus of elasticity, hardness, machinability, etc.

Since the interaction between carbon and silicon depends on the capacity to separate the iron carbide in

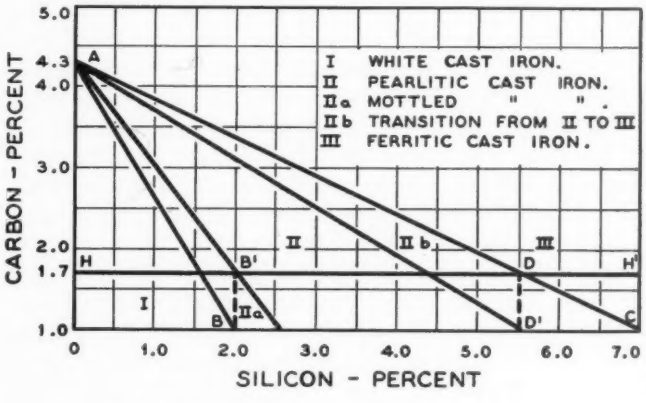


Fig. 1—The Maurer diagram for cast iron.

graphite and ferrite and is generally well known, the subject will not be further discussed. In the remainder of the paper the three alternative ratios of carbon to silicon, 1:1, 1:2 and 1:3, will be treated separately, and a survey of the procedure at the Göta Works given.

One Part Carbon Equals One Part Silicon

In the monthly journal of Krupp for July, 1924, Maurer published a structure diagram which came to play a great role in charging technique and became very popular, principally because of its simplicity.

In the diagram, the so-called unalloyed cast iron is divided into white, mottled, pearlitic, pearlito-ferritic and ferritic iron fields. All demarcation lines between the various fields issue from the point for the silicon-free eutectic iron with a 4.3 per cent carbon.

This paper was presented at the 1948 Convention of the Swedish Foundrymen's Association.

NOTE: Three additional articles on cast iron structure diagrams, abstracted from *la Fonderie Belge*, appear in American Foundrymen's Society TRANSACTIONS, vol. 54, pp. 855-860 (1946).

For example, in order to obtain a pure pearlitic structure with 2 per cent carbon the admissible silicon variation should be from 1.7 to 3.5 per cent, according to the diagram. The diagram shows that a variation of approximately 0.10 per cent in carbon is compensated by 0.10 per cent of silicon, so that if the carbon content is reduced by 0.1 per cent, the silicon content should be increased by 0.10 per cent.

The model for the diagram shown in Fig. 1 is the Guillet steel diagram. Maurer himself says so. On the origin of his diagram, Maurer says: "I have set the eutectic point *A* with 4.30 per cent C on the ordinate; upon the horizontal axis which represents the silicon content I have set the point *B* with 2 per cent silicon because tests I have made on the occurrence of graphite in steel show that steel can be cast with 2 per cent silicon and 1 per cent carbon without graphite separation. I have further taken the point C = 7 per cent silicon from the Guillet diagram for silicon steel.

"Thus I drew the straight lines *AB* and *AC* and in this manner obtained the three fields, which corresponded to white, pearlitic, and ferritic iron. Then in order to obtain the fields IIa and IIb I projected *B* straight up to B_1, that is to say, to the bisecting point on the horizontal line for 1.7 per cent C, because this content of carbon must be assumed as the demarcation line be-

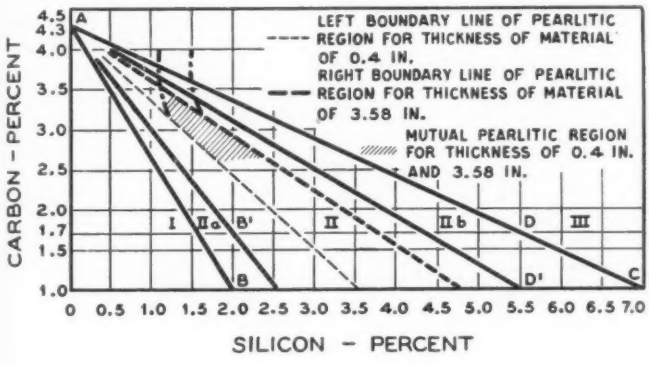


Fig. 2—Modified Maurer diagram for cast iron.

tween cast iron and steel. In the same manner *D* was projected straight down to D_1. Then I drew the straight lines AB_1 and AD_1 and thus obtained the fields IIa and IIb corresponding to mixed and pearlito-ferritic iron, respectively."

Although the diagram immediately became very popular, eventually doubts arose as to its correctness. Maurer himself was prepared almost at once to modify the diagram and in 1927, jointly with Holzhausen, he came out with a new diagram (Fig. 2). In this diagram is found a lined field which, when taking into consideration the cooling rate, i.e., the thickness of the material, shows a pearlitic region. The field embraces material thicknesses from 0.40 to 3.57 in. Other diagrams were developed by Klingenstein, Coyle and Greiner.

In an article written in 1947, Laplanche, metallurgist of the Citroen Works, is not sparing with criticism: "This diagram is a typical example of the mistake which can be made when an experimental question is resolved on the basis of an idea adopted before starting the work," Laplanche states in the article.

In further discussion Laplanche states: "The Maurer diagram has two fundamental errors. The first error is in drawing a diagram for all conditions, eliminating

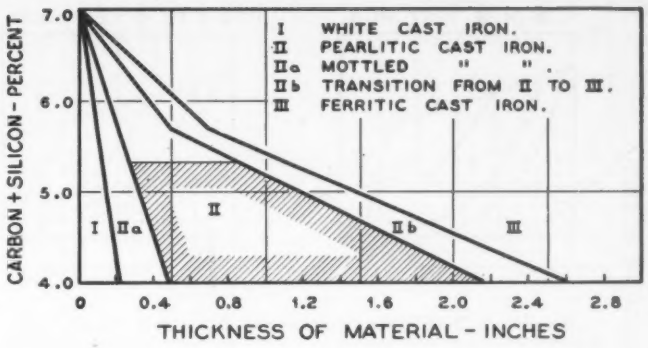


Fig. 3—Diagram for cast iron by Greiner-Klingenstein.

in this manner a great many factors, first of all the cooling of the metal in the mold and substituting thereby a kinetic with a static problem. The structure depends on the cooling curve. Maurer himself stated afterwards that his diagram is applicable only to test bars of 0.8 in., and that the demarcation lines move to the left with a slow cooling and to the right with more rapid cooling.

"The other error is the assumption that the demarcation lines are straight. If Maurer's diagram were correct then an iron with 0.50 per cent silicon and an increased amount of carbon should show all kinds of microstructures. With 4.40 per cent carbon we should get, for example, a pure ferritic iron, which is absurd, as everybody knows."

In a diagram (Fig. 3) set up by Greiner and Klingenstein an attempt is made to obtain the thickness of the material with even cooling rate. The diagram has the sum of carbon and silicon on the ordinate and the thickness of the material on the abscissa. It is assumed that the diagram is restricted to pearlitic cast iron. Compare, for instance, with the middle line in the pearlitic field in the Maurer diagram, which also has an angle of 45° on the same scale upon the ordinate and the abscissa, i.e., it shows that carbon and silicon have equivalent effect.

In the tridimensional diagram (Fig. 4) of Norbury, Ublitzsh and Walter, the Maurer and Klingenstein type of diagram has been developed. The straight boundary lines have been replaced by curved lines. The diagram is shown here in 4 sections for 1.2, 0.8, 0.4 and 0.24-in. test bars. It is interesting to see how the lines move to the right with increased cooling rate and how the pearlitic field shrinks in both the horizontal and vertical directions.

If all of the foregoing diagrams are considered from the point of view of how carbon and silicon are balanced in relation to one another, it will be found that in the case of gray iron of normal analysis and with a pearlitic structure this balance will be obtained, for example, for a 1.2-in. section, with approximately 3 per cent carbon and 2 per cent silicon. Every upward modification in the carbon content should be compensated by an equally large reduction in the silicon content; conversely, a lowering of the carbon content should be compensated by an increase of the silicon content according to these diagrams.

One Carbon Equals Two Silicon

In a lecture given in Berlin in 1930 and reported in *Die Giesserei* and in *Gjuteriet* (German and Swedish

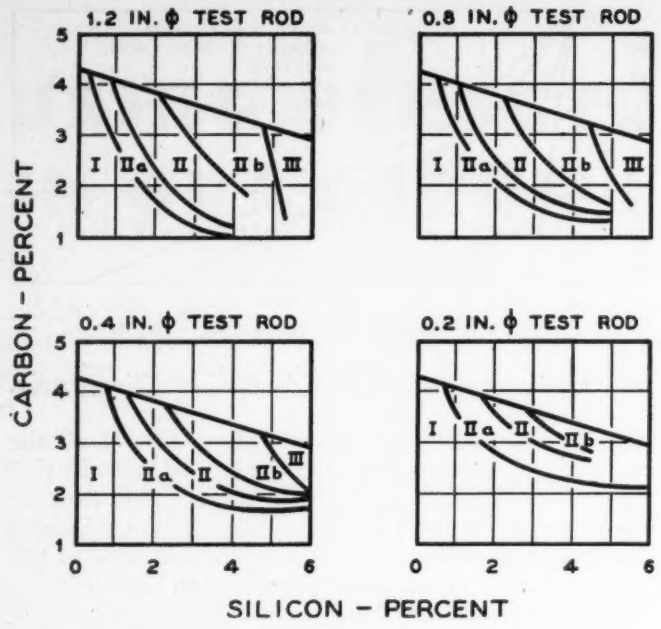


Fig. 4—Diagram for cast iron by Uhlitzsch-Weichelt.

foundry trade journals) Professor Osann expressed the opinion that cast iron should be alloyed to produce a eutectic structure. He believes that such iron not only possesses the best mechanical properties but also is easier to cast and more free of stresses.

Professor Osann states that by eutectic cast iron is meant an iron which has a pearlitic structure as cast. The composition of such an iron cannot be determined from any theoretical structure diagrams, least of all from the iron-carbon diagram since a cast iron contains at least six components and it is impossible to draw such a diagram.

According to Osann a definite eutectic point does not exist, but instead an endless number, changing in accordance with the composition. He states boldly: "Where there are the best properties there eutectic cast iron is found."

Consistently, Osann also builds his carbon-silicon prescription on a very practical basis. He starts out from his recommendation and recognizes suitable analyses for cylindrical material (Table 1) and from this gets the "proper" carbon and silicon contents (Fig.

TABLE 1—CARBON AND SILICON CONTENTS OF TYPICAL GRAY IRON CASTINGS

Use	C, %	Si, %
Synthetic Pig Iron	2.5	3.1
Emmel Material	2.9	2.0
Cylinders	3.1	1.6
Lanz Perlit	3.3	1.2
American Railway Car Wheels	3.5	0.9

TABLE 2—EUTECTIC C AND SI CONTENT FOR MATERIAL THICKNESS OF 1.6-2.0 IN.

C, %	Si, %	C, %	Si, %
2.5	2.8	3.1	1.6
2.6	2.6	3.2	1.4
2.7	2.4	3.3	1.2
2.8	2.2	3.4	1.0
2.9	2.0	3.5	0.8
3.0	1.8	3.6	0.6
		3.7	0.4

TABLE 3—ADJUSTING SI CONTENT TO SECTION THICKNESS

Thickness in.	Si, %	Thickness, in.	Si, %
40	−1.30	1.2	+0.20
20	−0.90	1.0	+0.25
10	−0.75	0.8	+0.30
6	−0.55	0.6	+0.45
4	−0.40	0.4	+0.60
3	−0.20	0.2	+0.85
2	0.00	0.1	+1.10
1.6	+0.10		

TABLE 4—ADJUSTING SILICON CONTENT TO PHOSPHORUS

P,%	Si, %
0.1	−0.15
0.2	−0.10
0.3	−0.05
0.4	0.00
0.6	+0.10
0.8	+0.20
1.0	+0.30
1.5	+0.55

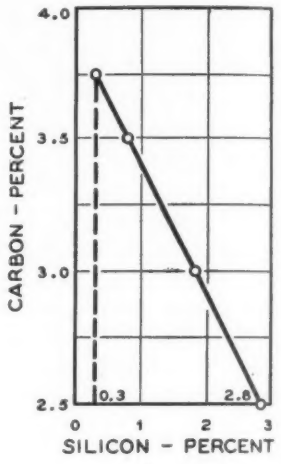


Fig. 5—Diagram of eutectic C and Si content by Osann.

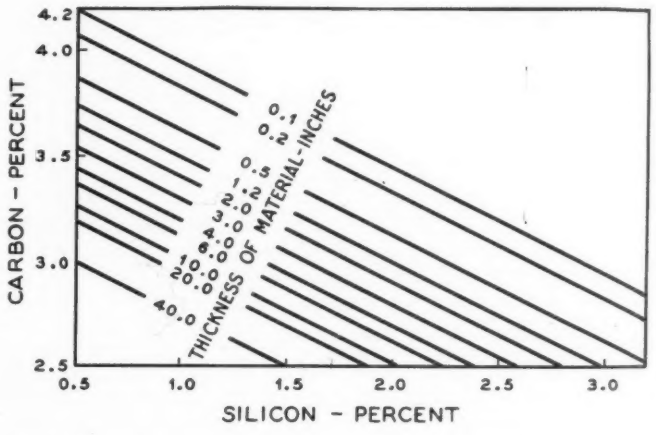


Fig. 6—Diagram for cast iron by Osann-Nordbeck.

5 and Tables 2, 3 and 4). Thereafter he makes corrections accounting for the thickness of the material and the phosphorus content.

In *Gjuteriet* for 1942 Nordbeck showed the directions of Osann in a diagram (Fig. 6). In general, the work of Osann has been well received.

A comparison of the diagrams of Osann and Maurer shows that the data given by Osann fall within the pearlite field of the Maurer diagram (Fig. 7). According to Osann, for example, with 1.2-in. material and 3 per cent carbon the silicon content should be 2.0 per cent; a modification of the carbon content by 0.1 per cent should be compensated through a modification of the silicon content by 0.2 per cent. Thus, if normal cast iron is involved, he considers that the effect of silicon is only half as great as that of carbon. Compare Maurer's central line of the pearlite field where 0.1 carbon = 0.1 per cent silicon.

In an article published in *Die Giesserei* for 1942, translated in *Gjuteriet* the same year, a German metal-

lurgist, Gimmy, revives the old concept of the "saturation degree" which he says ought to be used for the determination of the hardness or tensile strength range of cast iron. He gives a critical review of the curves and diagrams of Maurer, Osann, and others, and comes to the conclusion that they have overestimated the value of silicon in comparison with carbon.

One Carbon Equals Three Silicon

Saturation degree, S_c, is calculated from the formula

$$S_c = \frac{\%\ C}{4.23 - \frac{Si}{3.2}}$$

where the number 4.23 corresponds to the carbon content of the carbon-saturated silicon-free iron, and the number 3.2 designates the silicon content at which the carbon content of the carbon-saturated iron has been reduced 1 per cent. In other words, an iron with 3.2 per cent of silicon is carbon-saturated at a carbon content of 3.2 per cent.

With reference to the usual iron-carbon diagram it could also be said that with a silicon content of 3.2 per cent the base line point is shifted to the left from 4.2 to 3.2 per cent of carbon.

The formula was set up in 1910 by Heyn, and this may be one of the earliest attempts to predict scientifically the properties of cast iron. From a Hütte *Manual for Steel Mill and Foundry People* originates the prescription for the balancing of carbon, silicon and S_c shown in Table 5 and Fig. 8.

In modern American literature this formula is in general use, but the term of saturation degree, S_c, is replaced by the carbon equivalent, CE, and CE is then set forth as CE = total C + 0.3 (% silicon + % phosphorus). From this it can be shown that the saturation degree of unity corresponds to 4.23 carbon equivalent.

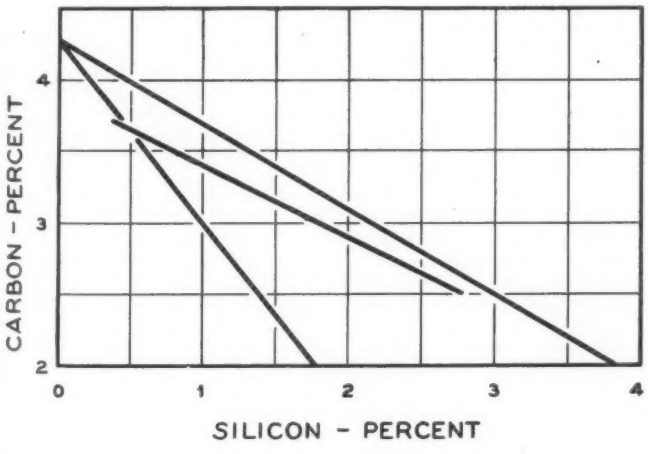


Fig. 7—Comparison of the Osann and Maurer diagrams.

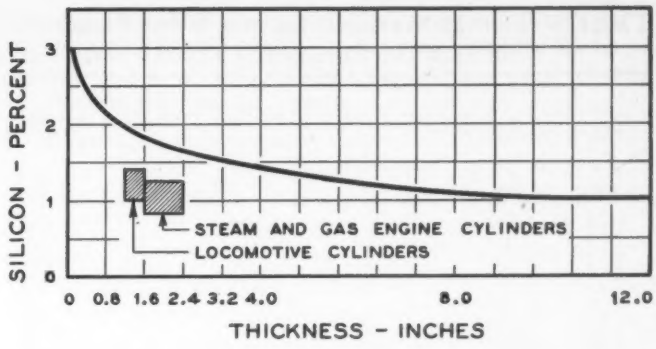


Fig. 8—Relationship of silicon content to section thickness of cast iron (see Table 5 for compositions).

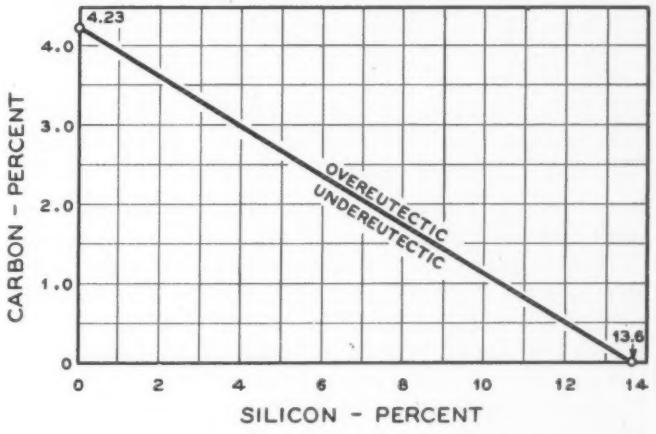


Fig. 9—Relationship between C and Si for saturation degree ($S_c = 1$) or carbon equivalent (CE = 4.23).

In addition, the following ratio can be established:

$$S_c = \frac{CE}{4.23}$$

$$CE = S_c \times 4.23$$

The relation between carbon and silicon with $S_c = 1$ or CE = 4.23 is shown graphically in Fig. 9. The influence of phosphorus has not been taken into consideration on this graph.

It is believed that by holding definite values on the constants it will be possible to obtain predetermined properties for the cast materials.

From the aforementioned article by Gimmy and from the American literature some examples will be given of the relationship believed to have been found between S_c or CE and the properties of cast iron. (Lines for the same saturation degree and tensile strength, according to Haneman and Schrader).

The diagram (Fig. 10) shows a certain interdependence between the saturation degree and tensile strength.

TABLE 5—TYPICAL GRAY IRON COMPOSITIONS

Use	Components, per cent					
	C	Si	Mn	P	S	S_c
Domestic and Stoves	—	ca. 3	0.4–0.8	>1	<0.1	0.9–1
Pipe	—	Curve	>1	1 and >1	<0.12	0.9–1
Slightly Machined Castings	—	Curve	0.4–0.8	0.5–0.8	<0.12	0.9–1
Locomotive Cylinders	3.2–3.6	1.0–1.4	0.6–0.9	0.7–0.9	<0.12	0.83
Steam Engine and Press Cylinders	2.9–3.2	0.81–1.5	0.3–0.7	0.2–0.6	<0.12	0.76–0.80
Wedges	3.5	1.6–2.5	0.8–1.0	<0.1	<0.1	0.9–1
Rollers (cylinders)	2.9–3.4	0.5–0.8	0.6–1.2	0.5	<0.1	0.71–0.83
Hardware	3.5–3.8	0.5–0.9	0.3–0.5	0.2–0.5	0.08–0.15	0.75–0.88

TABLE 6—TENSILE STRENGTH CHANGE WITH INCREASED SILICON AND CONSTANT CARBON

C, %	Si, %	Saturation S_c	Tensile Strength, σ_B 1000 psi	Decrease in Tensile Strength per 0.1% Si	
				1000 psi	%
2.75	1.48	0.730	64	—	—
2.75	2.03	0.765	57	1.3	2.00
2.75	2.60	0.805	50	1.1	1.97
2.75	3.18	0.850	43	1.2	2.46
3.00	0.99	0.765	57	—	—
3.00	1.61	0.805	50	1.1	2.00
3.00	2.24	0.850	43	1.1	2.26
3.00	2.93	0.905	36	1.0	2.40
3.25	0.62	0.805	50	—	—
3.25	1.31	0.850	43	1.0	2.06
3.25	2.04	0.905	36	1.0	2.26
3.25	2.81	0.970	28	0.9	2.60
3.50	1.15	0.905	36	—	—
3.50	1.99	0.970	28	0.9	2.40
3.50	3.07	1.070	21	0.7	2.35
3.75	1.16	0.970	28	—	—
3.75	2.32	1.070	21	0.6	2.25
Avg. decrease per 0.1% increase of Si content				1.0	2.25

Note how the lines of Osann and Maurer have an entirely different angle of inclination on the diagram.

Table 6 shows the variation of tensile strength with increased silicon and constant carbon content. On the average the strength has decreased by 1000 psi or 2.25 per cent for each 0.1 per cent increase of silicon content.

Table 7 shows the variation of tensile strength with increased carbon content and constant silicon content. With each 0.1 per cent increase of the carbon content the strength has decreased 4300 psi or 8.67 per cent.

Figure 11 shows the relation between carbon + 0.3 Si and graphite content, modulus of elasticity, and tensile strength. This curve is based on researches carried out in 1939 by an ASTM Committee under Bolton. Assuming the same cooling rate, the amount of graphite is increased in proportion to the quantity of carbon plus 0.3 Si. Since the modulus of elasticity is largely determined by the graphite content, it follows that this also is a function of C + 0.3 Si. As known, the tensile strength is influenced by the size and distribution of the graphite, and this explains to some extent the great

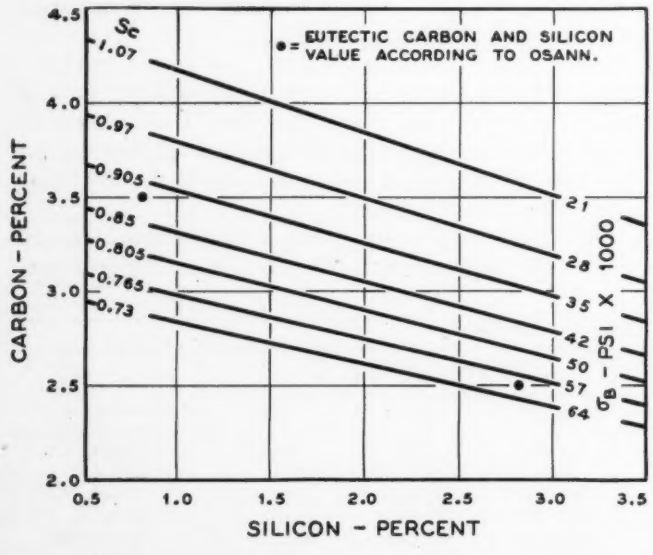


Fig. 10—Diagram showing the relation between saturation degree or carbon equivalent and tensile strength.

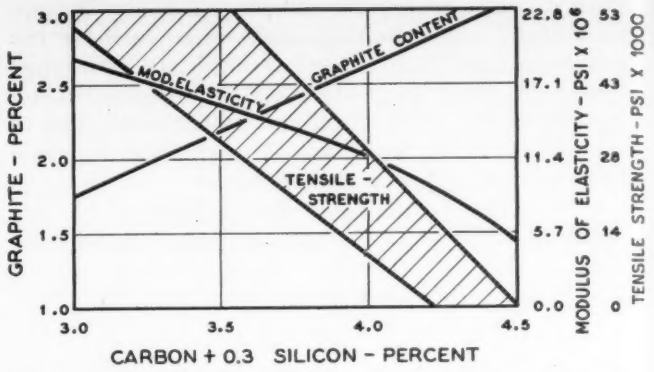


Fig. 11—Relation between CE (C + 0.3 Si) and graphite content, modulus of elasticity, tensile strength.

spread in the values. The great effect of the graphite on tensile strength becomes clear if its slight tensile strength is taken into consideration.

Table 8 shows the relation between the carbon equivalent and the Brinell hardness number. It seems that the BHN decreases almost in proportion to the increased carbon equivalent.

Great interest is shown in the use of the carbon equivalent or the saturation degree concept as an indication of cast iron tensile strength, etc., and certainly in many cases nearly full accuracy has been established, to judge from the published data. But, it should be self-evident that the specified values are not applicable under all conditions, and due to inoculation, superheating, etc., important fluctuations may take place. On the whole, it may be stated that a variation in the carbon content of 0.1 per cent ought to be compensated by a variation of the silicon content of 0.3 per cent.

TABLE 7—TENSILE STRENGTH CHANGE WITH INCREASED CARBON AND CONSTANT SILICON

C, %	Si, %	Saturation S_c	Tensile Strength, σ_B 1000 psi	Decrease in Tensile Strength per 0.1% Si	
				1000 psi	%
2.86	1.0	0.730	64	—	—
3.00		0.765	57	5.1	7.93
3.15		0.805	50	4.7	8.32
3.33		0.850	43	3.9	7.91
3.54		0.905	36	3.7	8.77
3.80		0.970	28	2.7	7.66
2.74	1.5	0.730	64	—	—
2.88		0.765	57	5.1	7.93
3.03		0.805	50	4.7	8.32
3.20		0.850	43	4.2	8.40
3.40		0.905	36	3.6	8.33
3.66		0.970	28	3.0	8.32
2.63	2.0	0.730	64	—	—
2.76		0.765	57	5.5	8.53
2.90		0.805	50	5.1	8.92
3.06		0.850	43	4.4	8.91
3.26		0.905	36	3.6	8.33
3.50		0.970	28	2.7	7.68
2.52	2.5	0.730	64	—	—
2.64		0.765	57	5.9	9.24
2.78		0.805	50	5.1	8.92
2.93		0.850	43	4.7	9.51
3.12		0.905	36	3.7	8.76
3.34		0.970	28	3.2	9.08
2.40	3.0	0.730	64	—	—
2.52		0.765	57	5.9	9.24
2.65		0.805	50	5.5	9.60
2.80		0.850	43	4.7	9.51
2.98		0.905	36	3.9	9.23
3.19		0.970	28	3.4	9.52
Avg. decrease per 0.1% increase of C content				4.3	8.67

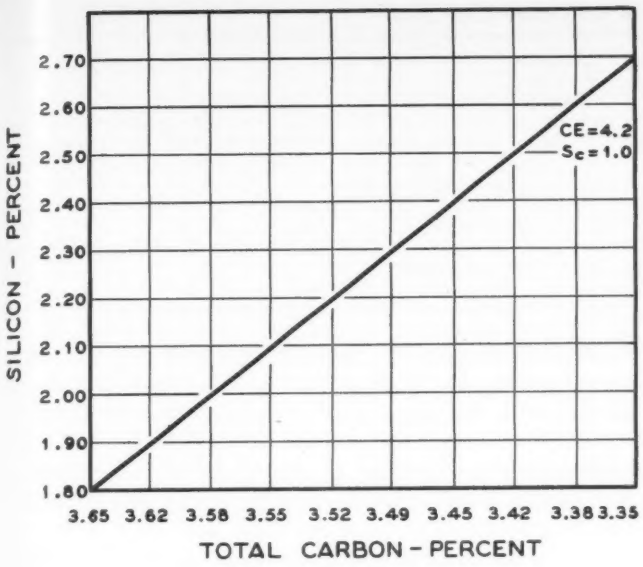


Fig. 12—Diagram showing silicon-carbon relationship.

In the past year researches have been reported which substantiate the practice of using the formula, Eutectic Carbon = 4.30 − 0.30 (% Si + % P).

Finally, it may be of interest to note the experiences of a pig iron manufacturer as shown in Fig. 12.

Production at the Göta Works consists of two entirely different types of castings. In the "machine foundry," trade articles in the form of heat plates are produced. In the motor foundry, parts for Diesel engines are cast, in addition to jobbing work on bulky and heavy castings. The machine foundry is operated exclusively with cupolas, and the motor foundry obtains its iron mainly from electric furnaces. The iron produced is of the highest quality and easily machined. Moreover, the castings produced are of more or less complicated design and of various dimensions. Frequently the casting thickness varies from 1.0 to 6.0 in.

The electric furnace practice is rather unusual. For example, cylinder liner iron is melted from 80 per cent scrap steel and 20 per cent cast iron chips and shavings, which means that careful attention must be given to charging. For this reason a special staff is assigned to handle this problem, a laboratory staff of five people.

TABLE 8—RELATION BETWEEN CE AND BHN

C, %	Si, %	CE	BHN	Tensile Strength, 1000 psi	Transverse Strength, lb	Deflection, in.
3.02	1.00	3.36	450	—	1750	0.10
3.15	1.10	3.52	390	—	2200	0.13
3.27	1.35	3.72	290	42	2400	0.20
3.24	1.60	3.76	270	44	2350	0.24
3.27	1.67	3.81	260	43.5	2400	0.28
3.29	2.05	3.95	235	37.5	2400	0.30
3.21	2.45	3.99	215	36	2350	0.26

TABLE 9—PEARLITIC CAST IRON—COMPOSITION AND SECTION THICKNESS

Components, per cent					Thickness, in.
C	Si	Mn	P	S	
3.2–3.4	1.2–1.5	0.7–0.9	0.2–0.4	<0.11	0.6–1.0
3.1–3.3	1.0–1.2	0.7–0.9	0.2–0.4	<0.11	1.0–1.6
3.0–3.2	0.8–1.0	0.7–0.9	0.2–0.4	<0.11	1.6–2.4
2.9–3.1	0.7–0.9	0.7–0.9	0.2–0.4	<0.11	>2.4

A score of years ago and for a long time thereafter this foundry endeavored to adapt its practice to the Maurer diagram. The result was that we were working with several different analyses, not only for castings for different purposes but with respect to different percentages of carbon and silicon for castings of the same type but of different thicknesses. For instance, cylinder liner castings for the principal machines are supplied in four different alloys. Table 9 shows an older material specification for pearlitic iron.

At present we are melting iron in the cupola. By adhering to suitable melting conditions and raw materials, pig iron, scrap, coke, etc., it was possible to obtain fairly constant composition, including the carbon, but unexpected divergencies could occur. There were always some difficulties because components of the various charges would segregate, particularly if the charges were small.

In addition, it often was difficult to machine material that had been alloyed: It was necessary to adopt such alloying practice that the smallest sections of the casting could be machined when required. This in turn reduced the number of iron mixtures.

In spite of this occasional complaints were received, mostly about difficulty in machining. In the cleaning department it was found that some castings tended to warp and had hard spots. Such material frequently had a lower carbon content, lower than that usually obtained with the same kind of pig iron and scrap. The cause of this lowered carbon content might have been due to the changed furnace coke. In correcting this condition, either the composition of the charge was modified so that the carbon content become normal or, on the basis of the Maurer or Klingenstein diagram, the silicon content was increased to the same extent that the carbon content was decreased.

It was not always easy to decide whether or not the corrective measures had the desired effect because the

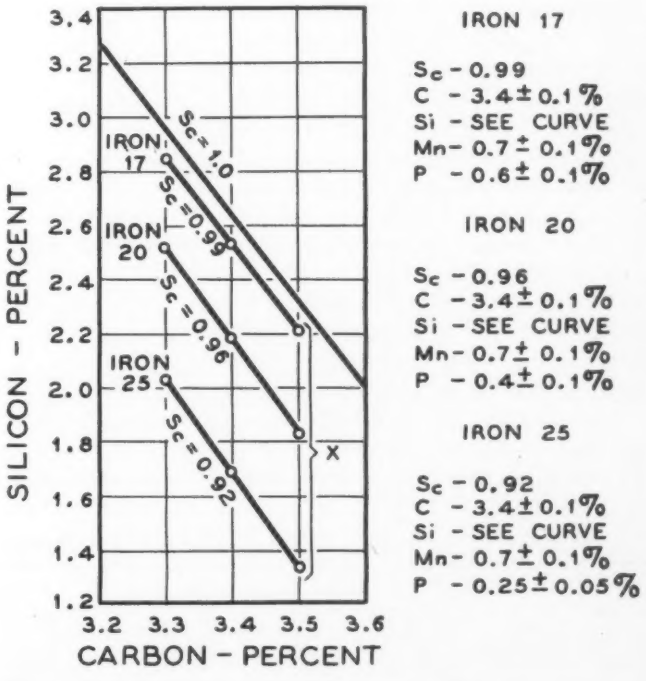


Fig. 13—Cupola charging diagram. "X" values are obtained by charging Si according to value on chart and the addition of 0.3 per cent Si as FeSi at the spout.

TABLE 10—CUPOLA IRONS—MACHINERY CASTINGS

Iron No.	Components, per cent C	Si	Mn	P	S	BHN	Tensile Strength, 1000 psi	Applications
17	3.3–3.5	2.7–2.1	0.7±0.1	0.6±0.1	<0.12	180	28.5	Bearing frames, ordinary machine parts requiring no particular strength, pipe, tubing, braces, smaller journals.
20	3.3–3.5	2.4–1.8	0.7±0.1	0.4±0.1	<0.12	190	28.5	Bearing frames, supports, flywheels, valve housings, pistons.
25	3.3–3.5	1.9–1.3	0.7±0.1	0.25±0.05	<0.12	200	35.5	Cylinder blocks, piston rods, bushings, bearings, journals.
30	3.0–3.2	1.4–0.8	0.85±0.1	0.35±0.05	<0.12	>200	>43	Pistons, cylinder linings.

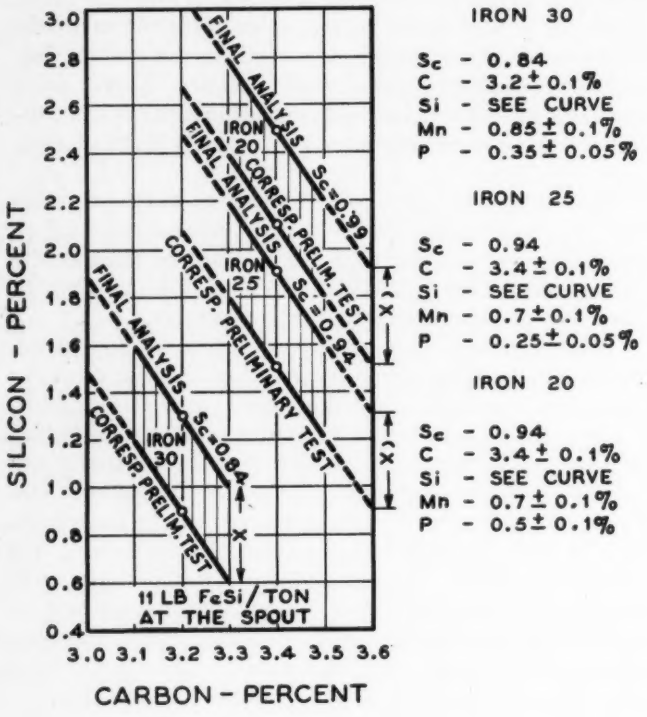


Fig. 14—C-Si charging diagram for electric furnace.

objectionable lot of the material might have been recast after new melting conditions were established. Difficulties, of course, were encountered not only with regard to hardness of the material and difficult machining, but frequently there were unexpected troubles in compression tests, and from occasional cracks, coarse grained iron, etc. On the other hand, the desired minimum tensile strength was almost always obtained. When access to raw materials became limited and difficult during the latter half of the 1930's it was necessary to buy iron wherever it could be found, and it was not always possible to obtain the desired analysis. Thus it became a problem to maintain the composition requirements and good qualities of the cast iron.

Our concern and problems were accentuated because we had to use our electric iron for quality castings. By reason of good supplies large quantities of steel scrap went into the electric iron. The result was that the carbon content became a more or less unstable factor, which had to be balanced by means of silicon. On the basis of the wedge test, in accordance with Sipp and Roll and the analysis of the iron, the deficiencies are corrected by additions of ferro-alloys in the furnace. The silicon content is then corrected, as previously stated, in accordance with Maurer or Klingenstein. It was also learned that the effect of the silicon became greater and that hard spots were noticeably reduced when a portion of the silicon was added at the spout.

Despite these changes the results were not satisfactory, the greatest problem being machining. After a survey of the alloying practice, an increase was made in the sum of carbon plus silicon. This was an improvement, but some uncertainty still remained.

It was decided to drop the conceptions of Maurer and Klingenstein regarding the interaction of carbon and silicon and establish a practice to fit the plant's particular need. The analyses of the mixtures was changed, and raw materials and castings were carefully inspected. All materials and castings were divided into six groups, and for each group the ideal percentage of carbon, silicon, manganese, phosphorus and sulphur was fixed. The strongest iron (C30) fitted into the pearlite field as defined by Maurer and Klingenstein. It was considered that manganese, phosphorus and sulphur contents could be kept constant.

In contrast, the carbon content could not be fixed exactly at a predetermined value, and this meant that the silicon content had to be modified in accordance with carbon content variations. It was known that this could not be done on the basis of the sum of carbon and silicon, i.e., that a modification of the carbon content by 0.1 per cent should be compensated by 0.1 per cent of silicon, and it was evident that a lesser amount of silicon would not do at all. Experiments were made on the basis of compensating every 0.1 per cent of carbon with 0.2 per cent of silicon, and later with 0.3 per cent of silicon. The castings were followed through the machine shop and were checked by means of chemical analysis and mechanical tests.

This work confirmed what was already known, namely, that a lowered carbon content was almost always

TABLE 11—ELECTRIC FURNACE IRONS—MACHINERY CASTINGS

Iron No.	Components, per cent C	Si	Mn	P	S	BHN	Tensile Strength, 1000 psi	Applications
20	3.3–3.5	2.8–2.2	0.7±0.1	0.5±0.1	<0.08	190	28.5	Bearing frames, supports, flywheels, valve housings, pistons.
25	3.3–3.5	2.2–1.6	0.7±0.1	0.25±0.05	<0.08	200	35.5	Cylinder blocks, piston rods, bushings, bearings, journals.
30	3.1–3.3	1.6–1.0	0.85±0.1	0.35±0.05	<0.08	>200	>43	Pistons, cylinder linings.

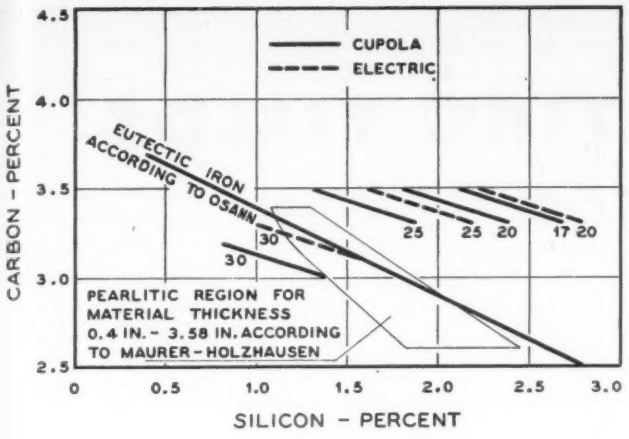


Fig. 15—Chart showing Gota Works cupola and electric furnace cast irons superimposed on Maurer diagram.

followed by increased difficulty in machining even if each 0.1 per cent of carbon insufficiency was compensated by 0.3 per cent of silicon. The improvement in machining achieved through a higher content of silicon was so important, however, that complaints from the machine shop gradually ceased.

The important thing, of course, was that improved machining was not gained at the expense of the casting and tensile properties of the iron.

It is our opinion that Maurer and Osann are overestimating the effect of silicon and that it ought to be figured that 0.1 per cent of carbon requires about 0.3 per cent of silicon, the value obtained from calculating in accordance with the saturation degree formula. We have entirely given up correcting iron composition in accordance with Maurer and Klingenstein and for the different types of products have begun to use cast iron of a definite degree of saturation. In conformity with Osann we believe that efforts should be made to obtain a pure pearlitic structure. Such a structure we have obtained by proper adaptation of the saturation degree to the dimensions of the casting. We have found a very definite relationship between saturation degree, structure, hardness, and tensile strength.

Tables 10 and 11, Figs. 13, 14 and 15 are charging diagrams and tables by which we are operating. Normally, we produce three or four types of cupola iron and three types of electric furnace iron. All irons are inoculated at the spout.

Titanium Metal Now Being Produced In U. S. For Commercial Exploration

TITANIUM, seventh most common of the earth's metals, and hitherto not available for commercial research because of the lack of a practical process for its production in metallic form, is now being produced at the rate of 100 lb daily by the DuPont Co., Wilmington, Del., for purposes of commercial exploration.

Several times as strong as aluminum and less than twice its weight, the silver-white metal is highly resistant to corrosion and has a higher melting point than commonly used metals. It is comparable to stainless steel in strength and corrosion resistance but weighs only a little more than half as much per unit of volume. For these reasons, it is believed that titanium and its alloys will open new fields of metallurgical applications in reciprocating mechanical parts and in jet engines.

Titanium oxide has been used for several years in paint pigments, and as an outgrowth of this application, basic research on the production of the metal in ductile metallic form was begun by DuPont prior to the war. The United States Bureau of Mines continued DuPont's efforts during the war and developed a successful method of refining it by the end of the war. Following this, DuPont resumed its research, which recently culminated in manufacture of 95.5 per cent plus pure titanium metal on a small scale at its Pigments Department plant at Newport, Del.

Titanium is being produced for exploration as a basic raw material for industry and engineering. It has many interesting properties but exhaustive research will be needed to develop its full possibilities. If titanium alloys work out as expected, scientists believe they may have a new family of structural materials far superior in many ways to any metals now known.

Titanium is so new as an industrial material that little is known about what it will do. Enough is known, however, to indicate that it can be used where a high ratio of strength to weight is needed. Reports of the Bureau of Mines and other organizations indicate that an early major use may be in high speed planes and other forms of transportation. It may go into corrosion resistant equipment and industrial machinery such as printing presses and textile equipment, in addition to its possibilities for reciprocating mechanical parts and jet engines.

Present price of titanium is $5 per lb for quantities of 100 lb or more in sponge form. Ingot prices will be set later. Small samples will be supplied without charge to industrial and university laboratories.

Future Meetings and Exhibits

STEEL FOUNDERS' SOCIETY OF AMERICA, Fall Meeting, Hot Springs, Va.—November 15-16.

NATIONAL FOUNDERS ASSOCIATION, Annual Meeting, Sheraton Hotel, Chicago—November 18-19.

MALLEABLE FOUNDERS' SOCIETY, Western Sectional Meeting, Palmer House, Chicago—Nov. 19.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Annual Meeting, Hotels Pennsylvania and New Yorker, New York—November 28-December 3.

SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS, Annual Meeting, Hotel Commodore, New York.—December 2-4.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, Electric Furnace Steel Committee, Annual Conference, William Penn Hotel, Pittsburgh—Dec. 2-4.

MAGNESIUM ASSOCIATION, Quarterly Meeting, Mellon Institute, Pittsburgh—Dec. 4.

MATERIALS HANDLING EXPOSITION, Philadelphia—Jan. 10-14.

MALLEABLE FOUNDERS' SOCIETY, Semi-annual Meeting, Hotel Cleveland, Cleveland—Jan. 14.

INDUSTRIAL FURNACE MANUFACTURERS ASSOCIATION, Cleveland—Jan. 24-25.

STEEL FOUNDERS' SOCIETY OF AMERICA, Annual Meeting, Chicago—Feb. 9-10.

BIRMINGHAM REGIONAL FOUNDRY CONFERENCE, A.F.S. Birmingham District Chapter, Birmingham, Ala.—Feb. 17-19.

AMERICAN SOCIETY FOR METALS, Sixth Western Metal Congress and Western Metal Exposition, Shrine Auditorium, Los Angeles.—April 11-15.

American Foundrymen's Society, 53rd Annual Foundry Congress, St. Louis—May 2-5, 1949.

INCREASING CASTING YIELDS

Steel Foundry Uses Exothermic Pipe Eliminator

Paul von Colditz
Canadian Car & Foundry Co. Ltd.
Longue Pointe, Quebec
Canada

This paper, one of the two which tied for the highest award in the Second Annual Technical Papers Competition sponsored by the Eastern Canada and Newfoundland Chapter of A.F.S., was presented at the Chapter meeting in Montreal, March 12, 1948.

PIPE ELIMINATORS commonly used in the steel foundry are either mildly exothermic or of the insulating type, or both. These serve the purpose of covering the open riser, preventing it from freezing at the air-metal interface and allowing the atmospheric pressure to act on the riser during the feeding of the casting.

It has been the experience in this foundry that the proper use and selection of pipe eliminator has much to do with avoiding shrinkage and obtaining a high yield. Too often pipe eliminators are given scant attention in considering yields and feeding ability of the risers. Consequently, castings are often over-risered to avoid longitudinal shrinkage, which is one of the most troublesome defects encountered in present foundry practice. Many devices have been used to overcome this defect, with varying degrees of success.

Recently, we have experimented with a thermit pipe eliminator, which is highly exothermic, and are now using this on several production castings. This exothermic compound provides the necessary heat for proper directional solidification in the casting, allows a reduction in riser size and increases the yield.

Before proceeding further, something should be said about the chemistry of the process. Thermit eliminator is a compound of finely divided aluminum and iron oxide together with other ingredients capable of forming additional steel. The chemical and physical properties of the compound must approximate those of the steel being poured, as some steel formed by the eliminator may become part of the casting. However, this presents little difficulty as the eliminator may be made to different specifications, including Ni-Cr alloys.

The action of the thermit may be simply explained by the fact that when finely divided aluminum is mixed

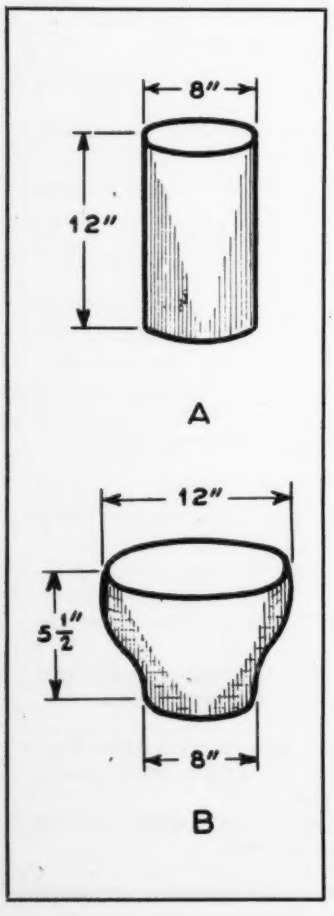
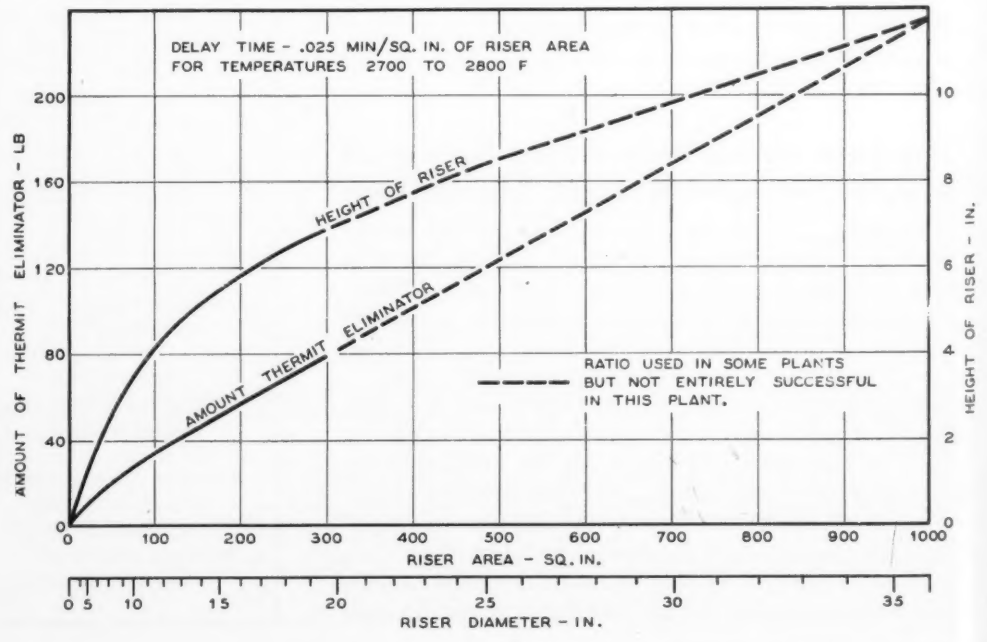


Fig. 1—Sketches of two risers having equal volume but different mold areas. A—Large mold surface area to volume and small open top area. B—Small mold surface area, large open area.

Fig. 2—Graph showing ratio of amount of eliminator and height of riser to cross-sectional area of riser.



with iron oxide and locally ignited by a small ignition charge of an oxidizing agent, an exothermic reaction takes place. The chemical equation is:

$$3Fe_3O_4 + 8Al \rightarrow 9Fe + 4Al_2O_3 + Heat$$

The products of the reaction are molten iron and alumina slag, with ferromanganese and ferrosilicon to form additions to the steel. Approximately ½ lb of steel is formed for every pound of eliminator used.

It is quite feasible to use this type of eliminator on metals other than steel. It has been used on iron and non-ferrous metals such as copper and nickel, with the corresponding oxides mixed with aluminum powder.

Regardless of the eliminator used, the casting must be properly risered to obtain the best yield and a solid casting. It has been found that the greater the mold surface area, the greater the loss of heat. Thus to feed a casting efficiently the riser should have the largest ratio of volume to surface area possible. Therefore, a riser having the smallest surface area possible, or that closest to a sphere, may be considered the most efficient.

Thermit pipe eliminator also appears to work best on the squat or spherelike type of riser shown in Fig. 1*B*. However, the reasons for this seem to be more than just a ratio of mold surface area to volume, and this may be seen in the comparison between the two risers shown in Fig. 1.

Figure 1 shows two risers of equal volume but different mold surface areas. In Fig. 1*A* the riser has a large mold surface area to volume, but small open top surface area. In Fig. 1*B* the riser has a small mold surface area to volume, but large open top surface area.

When a mildly exothermic or insulating type of eliminator is used, the eliminator is applied immediately after pouring and effectively seals the open top of the riser, so that the loss of heat from the open portion is considerably reduced. Thus the spherelike riser (Fig. 1*B*) with the small mold surface area, and the large open top surface sealed, may be considered more efficient than the cylindrical riser (Fig. 1*A*).

When using thermit pipe eliminator, there may be a considerable time delay during which the open top of the riser has no outside heat or insulation to offset the loss of heat from the top of the riser. Therefore at first glance it would appear that the riser (Fig. 1*B*) with the large open top would lose the greater amount of heat. This may be so. However, when the thermit eliminator is applied, the superheat reverses the direction of heat flow. Then as the thermit eliminator melts

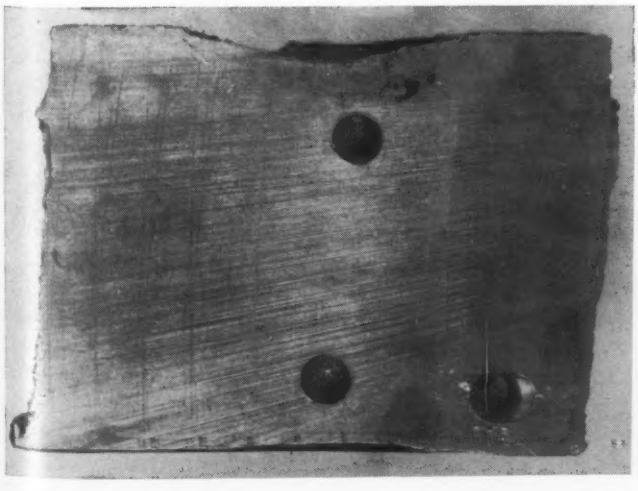


Fig. 3—Section of 9-in. diameter on which thermit pipe eliminator has been applied shows slight shrinkage.

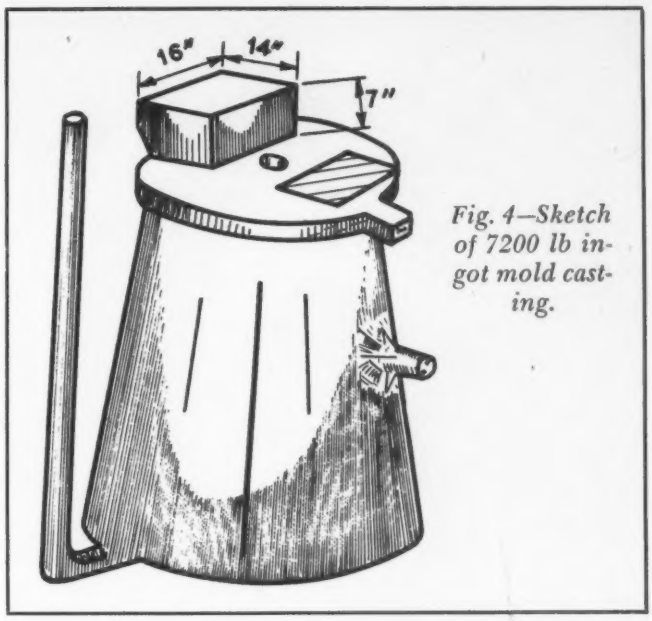


Fig. 4—Sketch of 7200 lb ingot mold casting.

only the metal with which it comes in contact, the larger surface area of the spherelike riser (Fig. 1*B*) has the advantage of increased molten metal over the cylindrical riser (Fig. 1*B*). Also, when the insulating slag forms on top, it once more becomes a ratio of mold surface area to volume. So here again, the squat or spherelike riser is favored.

From these theoretical deductions, and from practical experiments, it appears that the squat riser (Fig. 1*B*) is the most efficient regardless of the type of eliminator used.

Thermit eliminator is no more difficult to apply than any other eliminator. However, some calculations have to be made prior to the application. As may be seen in the graph (Fig. 2) there is a definite ratio of amount of eliminator and height of riser to the cross-sectional area of riser. These ratios have been established by experiment only, and have no theoretical foundation. However, these ratios are important if high yields and sound castings are to be obtained.

The riser is poured to the predetermined height, then the thermit eliminator is added in weighed amounts at the desired time interval after pouring, the amount and time interval being dependent on the pouring temperature and cross-sectional area of riser. A nail is placed in the riser to indicate the height to which the riser is to be poured. At the elapse of the time interval, the eliminator is dumped from a container into the riser. The eliminator ignites at approximately 2000 F, burning with a bright, sparkling light. The intense heat (approximately 4000 F) remelts the riser and a slight boiling action takes place, after which a slag forms on top.

It appears that the hot refractory insulating slag on top of the riser, plus favorable convection currents, control the cooling rate, so that the riser solidifies without the usual type of pipe. An example of this lack of shrinkage, may be seen in the photograph (Fig. 3). This shows a 9-in. diameter riser on which thermit eliminator was used. As shown in the photograph, the

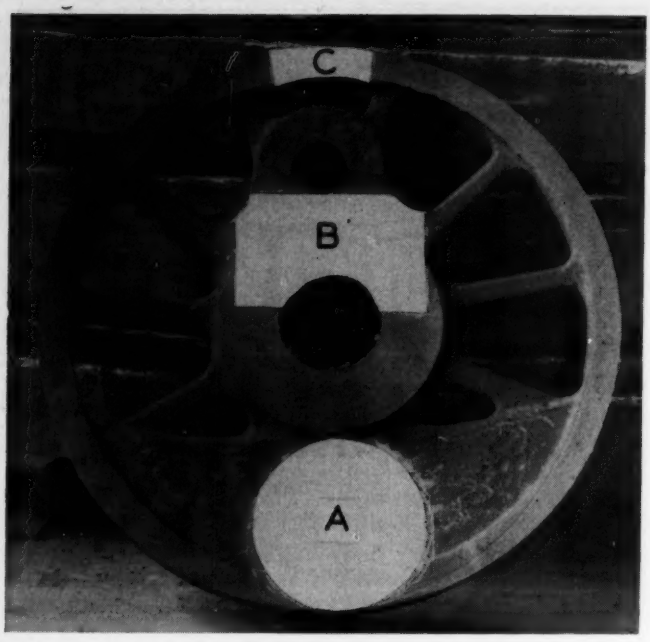


Fig. 5—Locomotive wheel casting shows riser position.

shrinkage is almost non-existent and is confined to the very top of the riser. The solid metal in the riser immediately above the casting is quite considerable as a safety margin and, as may be seen, the height of this riser may be still further reduced and yet a sound casting produced.

The delay time before placing the eliminator on the riser has a certain effect on the functioning of a thermit type of eliminator, as it tends to equalize unfavorable temperature gradients set up during pouring. Then the high heat of the eliminator produces a greater temperature gradient between the riser and the casting.

We have experimented with the delay time to some extent and still are not satisfied that we have arrived at the correct time figure for all sizes of castings and all pouring temperatures. A delay time of 0.025 min per square inch of cross-sectional area has been used successfully in some plants. However, in some cases we have increased the delay time to as much as 0.033 min, and have had good results.

If the thermit eliminator is added too soon, a great amount of the superheat is dissipated throughout the casting and the temperature gradient between riser and casting is not so pronounced. On the other hand, if it is applied too late it may not ignite, and the crust formed on top of the riser must be remelted, before feeding can be resumed. Figure 4 shows a 7200-lb

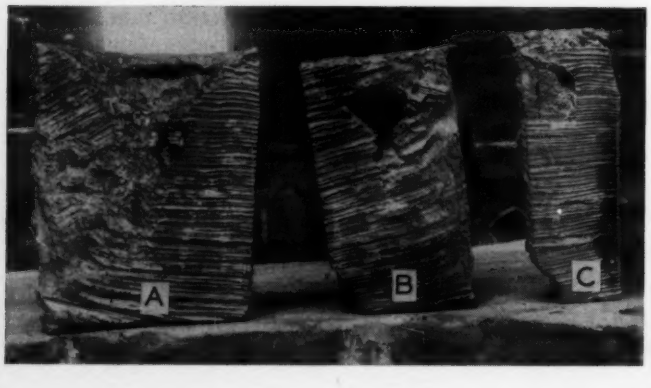


TABLE 1—YIELDS AND RISER DIMENSIONS

	Riser Type	
	Conventional	Thermit Eliminator
Casting Weight, lb	1505	1505
Riser and Gate, lb	1160	410
Ladle Metal in Gate and Riser, lb	1160	364
Ladle Yield, per cent	56.5	80.5
Metal Saved, lb		796
New Metal, lb		46
Riser A (12-in. dia) Height, in.	15–16	4½–5
Riser B (14 x 8 in.) Height, in.	15–16	4½–5
Riser C (7 x 5 in.) Height, in.	15–16	4½–5

ingot mold casting on which we have done experimental work to determine proper delay time.

The original 16 in. high head was reduced to 7 in. and 75 lb of eliminator placed on each riser. The time delay after pouring was stretched out to 35 min, or 0.15 min per square inch of cross-sectional area. To enable us to do this, a mildly exothermic eliminator was applied immediately after pouring—this preliminary application prevented a crust from forming on the riser. Then after a delay time of 35 min the thermit eliminator was added and, without a crust to melt, was able to produce a greater temperature gradient between riser and casting.

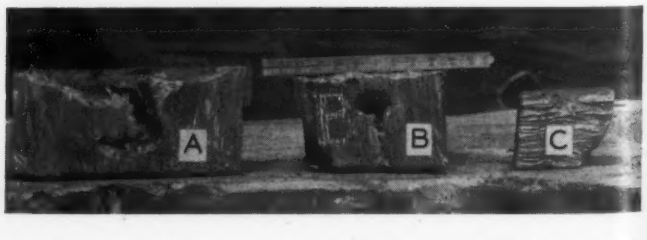
All the possibilities of this double application of eliminator on large castings have not as yet been correlated, but experiments to date indicate that this may have some advantages, especially on the larger castings.

More than 500 locomotive driving wheel castings have been produced with thermit eliminator applied to the risers, with excellent results. A photograph of this casting showing location of risers is shown in Fig. 5. Sectioned conventional risers for the locomotive wheel casting are shown in Fig. 6. The new risers, to which thermit eliminator was applied, are shown in Fig. 7 for purposes of comparison.

Thermit eliminator was used only on the two main risers *A* and *B* of the locomotive wheel casting, the riser *C* being treated with a mildly exothermic compound applied immediately after pouring (Fig. 5). The reason for this other application is that the original ratios of cross-sectional area of the different risers to the common height is correct for the main riser but out of proportion for the outside riser *C*. Consequently, on reducing the height of risers for thermit eliminator application the outside riser was brought into correct proportion. Thus it was considered that the riser *C* would feed adequately with a normal eliminator. This

Fig. 6—Conventional risers used for casting in Fig. 5.

Fig. 7—Thermit risers used on locomotive wheel casting (Fig. 5). Compare size of conventional risers in Fig. 6.



proved to be correct as no shrinkage has been encountered under these risers. Pertinent figures of weights and dimension of the two types of risers are shown in Table 1. Comparative riser sizes are shown in Figs. 6 and 7.

Risers were poured slightly over the recommended height due to the difficulty of pouring within ½-in. of the given height.

Drillings were taken in the center head at locations shown in diagram *A* Fig. 8 for chemical analysis. Physical test specimens were taken from riser *B* Fig. 8 and results of chemical and physical tests are shown in Table 2. The increase in height as shown in diagram (Fig. 8) over that given as poured is due to the new metal formed by the eliminator.

The amount of segregation shown close to the shrinkage cavity, and the loss of ductility in test bars from inside cuts and near shrinkage cavities is normal (Table 2). This is further shown when compared with tests made on a 10-in. diameter cylinder casting, which was well fed and had no shrinkage (Table 3).

Tests as shown in Table 2 were made on different castings produced with thermit eliminator, and in all cases the chemical and physical values were within the specified limits. The yield increase of 24 per cent on this casting constitutes a considerable saving in ladle metal. Although thermit eliminator is more expensive than the ordinary mildly exothermic compound, due to the reduction in ladle metal used and to the new metal formed by the eliminator a substantial saving in casting cost is possible.

Conclusions

From the experiments conducted in this plant it appears that the use of thermit pipe eliminator on some castings is beneficial both from a feeding and a cost point of view, particularly on castings having different sized risers and risers at different levels. Then it may be used to advantage on specific risers. A wheel with a high center hub is ideal for this application. The main center riser is reduced in height for use with thermit eliminator, while the small outside risers on the rim are still in proportion to be controlled with a mildly exothermic or insulating eliminator. This

TABLE 2—CHEMICAL AND PHYSICAL PROPERTIES

Chemical Analysis[1]

	Components, per cent				
	C	Mn	P	S	Si
Turnings from Cope Partially Under Thermit Riser	0.24	0.84	0.014	0.036	0.42
Position 1, Riser	0.35	0.87	0.033	0.067	0.38
Position 2, Riser	0.23	0.80	0.029	0.037	0.39
Position 3, Riser	0.23	0.87	0.016	0.035	0.38
Position 4, Riser	0.23	0.80	0.039	0.037	0.38

Physical Properties[2]

	Yield Strength, psi	Tensile Strength, psi	Elongation, % in 2 in.	Reduction of Area, per cent
Drag of Casting	40,100	77,500	31.0	54.1
Position 1	45,500	78,500	11.5	21.6
Position 2	45,100	77,350	12.5	27.8
Position 3	45,150	82,600	27.0	37.8

[1] Specimens taken from locations shown in Fig. 8A.
[2] Specimens taken from locations shown in Fig. 8B.

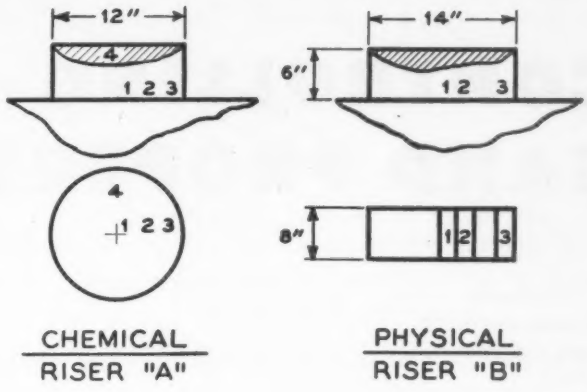


Fig. 8—Sketches showing locations from which chemical and physical test specimens were taken.

TABLE 3—PHYSICAL PROPERTIES—CYLINDER CASTING

Test Location	Yield Strength, psi	Tensile Strength, psi	Elongation % in 2 in.	Reduction of Area, per cent
Outside of Cylinder	33,800	72,960	30.0	47.1
Halfway	34,760	72,610	22.5	34.9
Center of Cylinder	34,480	70,800	21.0	22.9

combination of riser sizes and pipe eliminators has worked successfully with several castings of this type.

It is well known in the foundry industry that one foundry may have excellent results with a certain product while another has a great deal of difficulty. This does not necessarily reflect on the ability of the foundry concerned or the product, but rather on the different type of work produced, and different methods of production. Thus it is up to the foundry concerned to work out its own particular difficulties.

We have had our share of trouble in adapting the thermit type of eliminator to all sizes of castings, and have not had complete success on the larger castings. However, on the small type of casting with risers under 100 sq. in. of cross-sectional area excellent results have been obtained, but these have not been altogether profitable from a cost point of view. With castings having risers of over 100 but under 300 sq. in. of cross-sectional area, the results as to feeding ability, yield, and costs have been excellent.

Application of thermit eliminator to the risers of castings larger than those heretofore mentioned has not been as successful as with the smaller castings, the greatest difficulty encountered being shrinkage under the riser. This presents quite a problem, as it is not simply a case of increasing the riser but, due to the number of variables such as pouring temperature, height of riser, amount of eliminator and delay time, becomes rather a question of finding the proper ratio of one variable to another.

Acknowledgment

The author wishes to express appreciation to R. Thompson, assistant metallurgist, Canadian Car & Foundry Company Ltd., Longue Pointe Plant, for chemical and physical tests, and for supplying all photographs used in the paper.

CONTROLLING MALLEABLE SAND PROPERTIES

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IT HAS BEEN STATED that the production of malleable iron castings is the most difficult of foundry processes. If this is true, then sand control in the malleable foundry and coreroom is of utmost importance.

A recent survey of the malleable foundry industry brought out the following facts with regard to sand practice:

1. Castings ranged from small pipe fittings to large, complicated tractor and truck housings.
2. In general, the survey showed that casting weights ranged from 0.75 to 50 lb.
3. Sand processing equipment included sand cutters, pug mills and all types of mullers.
4. Most of the foundries had only partial specifications for incoming molding materials.
5. All foundries had ideas on sand properties and had laboratory facilities to check them. There was, however, a wide spread in the following properties: Green compressive strength: 3.0-5.0 to 9-12 psi; moisture, 2.3-3.2 to 3.5-4.5 per cent; permeability, 20-30 to 150-180. From these figures, it is apparent that the subject of malleable sand is open to a wide variety of opinions, depending largely upon the casting produced.

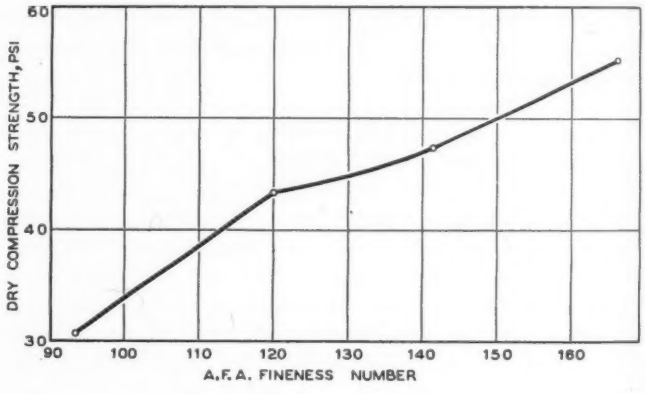
Since it is common practice to control some sand properties through the core sand, the discussion may well start in the coreroom. The sand selected for cores should be of the A.F.S. Fineness No. required to obtain the sand properties desired in the foundry. The sand must possess the proper permeability characteristics for the type of work produced, and should be of the fineness necessary to give the casting finish required.

Making Core Mixture Additions

In order to obtain uniformity in the core sand, dry sand should be used as a base so that standard amounts of water can be added later to obtain a definite moisture content. All of the dry ingredients should be added first, then the water, and last the core oil. Mixing should be sufficiently long to insure thorough coating of the grains. The conventional materials used are cereal binders to impart green strength, and one of the several commercial core oils.

Where certain cores are subjected to considerable abuse from the metal, such as at gate locations or other localized hot spots, it has been found advantageous to use a bonding clay as a binder to lend additional hot strength to prevent cuts and washes. Some of the bonding clays have a high capacity for absorption of oil and, therefore, the selection of a core oil must be made with care.

The use of phenolic resins as core binders is comparatively new, and in many foundries they have found favor. It has been found that core costs can be reduced, baking times and temperatures cut down, and that the hard cores produced are resistant to damage in handling. Although cores made with resin binders are hard, they result in none of the casting defects, such as hot tears, commonly attributed to hard cores.



Relationship of fineness of sea coal to dry strength.

Cores made with resin binders have been found to produce about 30 per cent less gas in the mold, and it is well known what that means in terms of possible scrap. Another factor of importance is that the baking process is merely a curing process, and cores made with thermosetting resins will resist overbaking to a marked degree. This means that the light sections of the cores still will be in good condition after the heavy sections have been properly baked. This property is quite important, eliminating as it does the condition in which the heavy section of a core still is soft when the light sections have reached the crumbling stage.

Since hard iron castings are particularly susceptible to hot-tear formation, it often is of advantage to use sawdust or wood flour in cores. This material burns out readily, thus providing voids for the natural expansion of the sand grains. This allows the casting to contract, and the stresses which cause hot tears are nonexistent. It has been the author's experience that the

This discussion was presented at a Sand Shop Course session of the 52nd Annual Meeting, American Foundrymen's Society, in Philadelphia, May 3-7, 1948.

soft wood flours of not too great fineness achieve the best results. Of course, the soft packing of cores also will aid in eliminating hot tears.

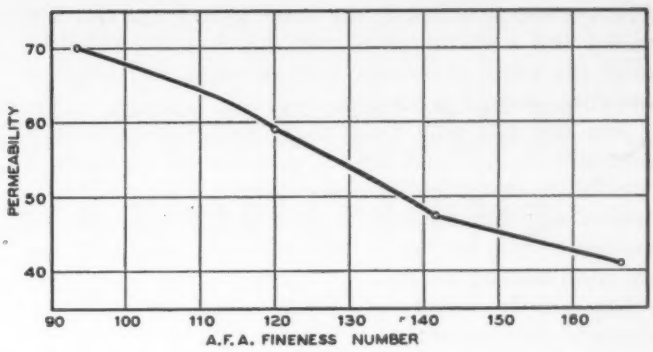
As mentioned previously, the range of properties desired in foundry sand varies widely, depending upon the type of castings being produced. Since it is impossible, within the limits of the present paper, to discuss each type of sand, the approach to the problem will be confined to the methods by which the sand is prepared, i.e., continuous or intermittent mills or sand cutters.

In foundries which use sand cutters, it is common practice to shake out the castings and heap the sand into long, low piles, adding the bond and sea coal to the piles. Sometimes bond and sea coal are added to the tops of the molds before dumping. The piles are cut through dry and again cut after the addition of tempering water. The molder usually adds this water.

Another means of bond addition is through the use of a heavily bonded mixture made up in a muller. This mixture usually is composed of up to 30 per cent bond with sharp sand and is distributed over the heaps to maintain the desired sand properties. It offers the advantage over additions of naturally bonded sand in that less sand is added to the heaps, with a consequent saving of a relatively expensive material. Naturally bonded sands also are subject to wide variations in clay content, which tends to upset procedures.

Characteristics of the sand prepared by the sand cutter are largely dependent upon the molder who adds the moisture, and upon other "oldtime" employees. However, the number of "oldtimers" who can come in every day and do a good job is decreasing rapidly, and the trend is toward mechanical sand mixing and handling. It also is possible to eliminate the general use of facing sand in a shop by the installation of a good sand system. This means that the costs attendant upon the preparation and delivery of good facing sand can be reduced.

Mechanized foundries frequently turn to continuous pug mills, blade type mixers or the various types of mullers for sand conditioning. The sand handling in a typical unit might follow this pattern; the mold is shaken out and the sand travels over a magnetic pulley to an elevator, and then into a storage hopper. It is fed out of this hopper at the rate desired, into the mill if the system is continuous, or in batches if to a muller. In the continuous system it is possible to introduce the sea coal and bond onto the sand stream before it enters the mill. These also can be added at the point where the sand enters the mill. With intermittent mullers, the dry materials are added to the sand in the mill, and then the water. In the continuous mill the water is sprayed in at the charge end. After mixing, the sand is discharged into an aerator or revivifier where it is fluffed, and then delivered to the molders.



Relationship of fineness of sea coal to permeability.

Quite often the sand system does not provide for proper cooling of the sand. In such cases it is desirable to add a barrel type unit to cool the sand by tumbling. Another feature which is quite worthwhile and contributes to more uniform sand conditions is proper storage capacity for the sand after it has been prepared. It has been shown that the sand develops slightly better properties and is more flowable if allowed to stand at least ½ hr after preparation.

The slurry method of clay addition to sands also is finding wide favor as a standard foundry practice.

TABLE 1—SCREEN ANALYSES OF SAND AND VARIOUS SEA COALS

Screen No.	Remaining on Screen, per cent: Washed-Dried Sand	Sea Coal No. 2	Sea Coal No. 3	Sea Coal No. 4	Sea Coal, low fines
12	0.0	0.0	0.0	0.0	0.0
20	0.0	1.9	0.5	0.0	0.3
30	5.6	6.1	3.0	0.6	3.1
40	24.9	11.6	7.0	2.8	8.0
50	10.3	12.1	10.5	6.9	14.0
70	15.0	10.5	10.8	9.5	15.7
100	27.1	13.4	14.2	14.6	21.2
140	12.7	10.5	11.9	13.3	16.9
200	3.4	7.9	9.1	10.8	9.1
270	1.0	3.6	4.4	5.1	2.7
Pan	0.0	22.4	28.6	36.4	9.0
A.F.S. Fineness No.	59.6	120.0	141.5	166.5	93.5

TABLE 2—EFFECT OF VARIABLE FINENESS OF SEA COAL ON SAND PROPERTIES

	W/O Sea Coal	Sea Coal: No. 2		No. 3		No. 4		Low Fines	
Bond, per cent	7.5	7.5	*6.75	7.5	*6.75	7.5	*6.75	7.5	*6.75
Sand, per cent	92.5	82.5	83.25	82.5	83.25	82.5	83.25	82.5	83.25
Sea Coal, per cent	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Moisture, per cent	2.6	3.2	3.0	3.2	3.0	3.1	3.0	3.2	3.0
Deformation	0.0163	0.0168	0.0153	0.0173	0.0155	0.0158	0.0170	0.0161	0.0155
Permeability	12.0	60.0	58.0	50.0	47.6	43.3	41.0	71.6	70.0
Green Compression Strength, psi	9.93	11.1	10.2	11.2	10.45	11.36	10.9	10.4	9.63
Green Shear Strength, psi	2.66	2.8	2.4	2.75	2.4	2.83	2.46	2.63	2.3
Dry Compression Strength, psi	28.1	45.0	43.5	47.6	45.0	55.3	48.3	34.8	30.6
Dry Shear Strength, psi	7.33	7.33	7.0	9.8	7.66	10.16	8.5	6.83	6.33

* In these mixtures the sand to clay ratio is the same as in the straight bond test.

When a slurry is used, the sand grains are quickly coated and a minimum of mulling time is needed to bond the sand. Less clay may be used and a lower moisture content is possible.

Just the fact that a foundry is equipped with a mechanical sand handling and preparation system does not always assure better sand. In fact, if permeability, moisture and bonding additions are not closely watched the results may be poorer than those obtained with the old sand cutting method.

Some of the factors which affect moisture with mechanical systems are:

1. Sand temperature—with hot sand a serious loss of water by rapid evaporation occurs, and the man at the sand mill must be alert for temperature changes.

2. Rapid sand turnover—the relation of the turnover to the size of the sand system is very important. With a small system it is necessary to add more water to compensate for the higher evaporation.

3. When light castings are produced, less moisture is lost than when the work is on the heavy side.

In order to maintain uniform sand for the molders, bond additions must be carefully controlled. The amount of bond required is affected by the following factors in the foundry practice.

1. Types of jobs being poured. The heavier the jobs, the greater the bond additions required to maintain the necessary strength.

2. Type of bond used. It has been found that some bonding materials are less durable than others; hence, greater additions are necessary.

3. If sand turnover is rapid, bond must be added more frequently to maintain sand properties.

Permeability is affected by:

1. Sand grain size and distribution.

2. Sands subjected to high temperatures show reduced permeability.

3. Amounts of bond and sea coal in the sand. In order to obtain the desired sand properties, additions of sea coal or equivalent seem to be a "must" in the malleable foundry. In these times of material shortages, many foundries have experienced difficulties with this material.

Table 1 shows the fineness of several sea coals, as determined by screen analysis, compared to that of molding sand. Table 2 shows the results of 10 per cent additions of the various sea coals on the green and dry properties of molding sand. It will be noted that with the finer sea coals the permeability is reduced as much as 60 per cent, while with the low fines material the reduction is about 33 per cent. At the same time the dry strength of the sand is markedly increased by additions of the finer sea coals.

Gray Iron Founders' Offices Moved

THE GRAY IRON FOUNDERS' SOCIETY moved into its newly furnished suite of offices in the National City Bank Bldg., Cleveland, Ohio, on October 1. Formerly located in Cleveland's Public Square Bldg., the Society found it necessary to acquire larger quarters because of its rapidly expanding activities.

R. L. Collier, executive vice president of the Society, extends an invitation to members of the Gray Iron Founders' Society and friends of the industry to visit the new headquarters.

Substitution Of Nickel For Tin In Engineering Bronzes Successful

NICKEL AS AN ALLOYING ELEMENT to replace tin in the manufacture of "bronze" has recently come into its own in a wide variety of engineering applications as a result of the current shortage of tin. Although tinless compositions have been in engineering use for several years under the name "bronze" it has been only recently that their acceptance has been widespread, as a result of the tin shortage, in such applications as bearings, worm gears, steam valves, and fittings.

A composition of 8 per cent nickel, 10 per cent lead, 2 per cent tin, 1 per cent antimony, balance copper, has proven under controlled laboratory tests to have superior wearing qualities and equivalent compressive yield strength to the time-honored bearing composition of 80-10-10, copper, tin and lead.

A manufacturer of worm gears has found that 8 per cent antimony and 2 per cent nickel successfully replaces an equivalent percentage of tin in bronze gears operating in high speed reducers with bath lubrication. Another firm offers a wrought nickel bearing bronze of 4 per cent zinc, 4 per cent lead, 2 per cent nickel and 2 per cent tin, nickel replacing 2 per cent of tin.

In general, engineering bronzes may be classified broadly into three categories: bearing, pressure, and structural bronzes.

In the bearing field, in addition to the above-mentioned application, a number of other alloys involving nickel in amounts from 1 to 5 per cent have shown merit. One of these, having a composition of 5 per cent tin, 9 per cent lead, 4 per cent zinc and 1 per cent nickel has been specified for cast bearing and bushing service as a substitute for 88-10-2 and 80-10-10 compositions.

Alloy Used in Pressure Valves

In manufacturing steam valves and fittings for applications for pressures and elevated temperatures, a Philadelphia foundry uses an age-hardenable 88 per cent copper, 5 per cent nickel, 5 per cent tin, and 2 per cent zinc composition for all castings previously supplied in 88 per cent copper, 10 per cent tin, and 2 per cent zinc bronze. The foundry claims that the nickel bronze is easier to make, has a more uniform and dense structure in heavy sections and delivers better wear resistance. The casting averages 48,000 psi unheat-treated and is strengthened to approximately 75,000 psi in the treated condition.

Although the metallurgical constituents resulting from nickel additions differ considerably from those produced by tin, the mechanical properties effected have much in common. Both improve tensile and compressive strengths and hardness. As distinct from tin, nickel is credited with the properties of densifying bronzes, reducing true grain size, and in the case of lead-containing bronzes, promoting even and fine distribution of the lead. There are also indications that small additions of nickel improve creep resistance. To establish the truth of this contention a research program is currently under way at the International Nickel Co. covering a wide range of standard engineering bronzes both with and without nickel.

The above article, "Substitution of Nickel for Tin in Engineering Bronzes Successful" was excerpted from the August, 1948, issue of *Nickel Topics*, publication of the International Nickel Co.

SELECT MOLD AND CORE WASH TO MEET CASTING CONDITIONS

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FOUNDRYMEN have quite frequently referred to core and mold washes as "necessary evils." In defense of these materials, one can rationalize and state that anything that accomplishes good cannot at the same time be an evil. True, it would be a foundryman's Utopia if many of the things used in a foundry were eliminated; in fact, there are foundry operators who wish they did not have to use cores at all. However, most castings require cores and most cores require coating. The fact that thousands of tons of core and mold washes are used each year is proof that they form an important part of foundry procedure.

Fortunately, there is a strong movement in the foundry industry to standardize tests and terminology, to make a completely honest approach to the problem of finding out what makes washes tick and to determine those methods of using washes that give the maximum in good casting finish. In the following paragraphs an attempt will be made to correct, as far as possible, many of the misundertsandings that all too frequently impair and even destroy the results which washes were designed to accomplish.

Why are core and mold washes used? How do they act? They are used to produce better casting surfaces than could be produced without them. By better casting surfaces is meant, on the one hand, improved smoothness, and on the other hand, elimination, or at least reduction, of those surface defects that require extensive and costly treatment in the cleaning room.

The sale of many types of castings is influenced by eye appeal. A smooth, trim-looking casting influences the public as well as the company that buys it for reprocessing. It just naturally reflects careful foundry practice and the buyer's first reaction is, "That must be a *good* casting!"

It will be noted that reference is made only to casting surfaces. By no stretch of the imagination can a core or mold wash be said to affect a casting below a very thin layer of the surface. Conditions inside the casting are the province of the casting designer, the metallurgist and the foundry supervision. By the same token, a wash, whether for cores or molds, has an effect only at the surface of the sand and to a depth of from two to five sand grains.

It is folly to expect a wash to compensate for cores or molds that are made from improper sand mixes or are poorly constructed. No wash will prevent metal penetration in soft-rammed spots. Neither will it prevent rat tails caused by sand cracking, buckles caused by sand expansion, nor dirty castings caused by the metal cutting or eroding the sand surface of core or mold. In spite of these facts an amazing number of casting defects are blamed on the wash. Core and mold washes will definitely aid good cores and molds in producing smoother, cleaner surfaced castings. That is all they are intended to do.

How do core and mold washes function? This is best described by first dividing washes into two classes from a formulation standpoint. One class is based on graphite or some other form of carbon. The other class is based on a mixture of refractory materials.

Select Wash for Job

Although carbon-base and carbon-free washes accomplish the same purpose, there are differences which should be recognized. Certain inherent characteristics of the metal in some gray iron foundries cause the carbon-free washes to leave a white deposit on the casting surface. Sand or shot blasting will in some cases remove this white coloration, but in other cases seem only to imbed it. In such instances the carbon-base washes will give to the castings that characteristic gray iron color so desired by many foundrymen. In some foundries the graphite-base washes show a better peel of sand than do the carbon-free washes.

Graphite-base washes cannot be used where the presence of carbon is objectionable. They are never used on cores or molds for low-carbon steel, since this metal is hungry for carbon. They are not used in the production of castings that are to be enamelled since even a slight coating of graphite seriously affects the adherence of the enamel. Shot blasting does not help because the shot itself becomes coated with graphite.

Claims have been made that graphite-base washes improve the machinability of gray iron castings. They might have a slight effect on low-carbon irons. However, some investigators have taken thin shavings from the surface of a gray iron casting made in a mold coated with a graphite-base wash and have found them to contain no more carbon than the rest of the casting. It is not to be expected that gray iron containing the normal percentage of carbon would absorb graphite since its carbon requirements are satisfied.

Where carbon-free washes can be used with no objectionable effect on the castings, they are preferred by some foundrymen because they are clean to use and

Presented at the Regional Foundry Conference, at Michigan State College, Lansing, Mich., Oct. 1, 1948.

the molders can see better in setting the cores and in removing loose dirt and other debris from the molds.

The problem of selection of the best core or mold wash for a specific job can be approached from a common-sense standpoint. It is best to begin by considering the three purposes for which a wash is used; first, to prevent sand from fusing to the casting surface, thereby improving peeling of the sand from the casting; second, to prevent metal penetration into the sand, and third, to produce a smoother casting surface. Let us analyze the action of the wash in accomplishing these three things.

The tendency for sand to sinter on a casting surface is proportional to the temperature at which the metal is poured. Naturally, the higher the pouring temperature the more attention the foundryman pays to the sintering point of the sand he uses. If he is pouring high-temperature steel he uses a high grade silica sand and, since he should not use a carbon-base wash, he must choose a highly refractory wash that is carbon free. He then uses silica flour in the sand to work with the wash in preventing metal penetration.

If he is pouring gray iron he uses a core sand and a molding sand with a good, safe sintering point, but not necessarily as high as must be used for steel. He can choose either a graphite-base wash having good heat resistance or a carbon-free wash having a fairly high fusion point.

Preventing Metal Penetration

As we go down the list of casting metals, in order of decreasing pouring temperature, we gradually lose concern over the ability of a wash to withstand the action of the metal temperature alone. For many brasses and bronzes and for aluminum and magnesium, washes are not needed to protect the castings from a high-temperature effect on the sand. They are, however, important for preventing metal penetration into the sand and for improving casting finish. Since resistance to high temperatures is now of secondary importance, a wash which seals the sand surface and fills the spaces between the sand grains should be selected. Certain bronzes have a strong tendency to seep into the sand, due to their fluidity and high specific gravity. For these metals the wash must effectually seal the sand surface.

Regardless of the size of a casting, the severity of action of the metal on the sand is proportional to the thickness of the metal section. Heavy sections require little or no consideration for the degree to which a wash fills the sand surface to give smoother casting finish. Heavy sections somewhat increase the requirements on the degree to which the wash prevents metal penetration. Heavy sections greatly increase the demands on the heat resistance and refractory properties of the wash, so much so in fact, that two or more coatings of wash are often applied.

Heavy sections require protection of the sand to a much greater depth than do light sections. This means that the wash must penetrate into the sand from three to five grains deep. This can be accomplished in two ways. A wash can be used that is so formulated that its natural tendency is to penetrate the sand, or a small amount of wetting or penetrating agent can be added to the wash solution. Since a wash will penetrate deeper the lower the Baumé, it is customary, where at least two coats of wash are applied, to use the first coat at a low Baumé for penetration and the second coat at a higher Baumé to form the protective film.

The foregoing paragraphs have dealt with the two types of core and mold wash from a formulation standpoint, namely, carbon-base and carbon-free. Another division of washes can be made from the standpoint of the form in which they are shipped, namely, dry powder and paste types. Dry powder washes are packed in oak casks, sugar barrels and multiwall paper sacks, whereas paste type washes are packed in open-head drums.

It is possible, but not advisable, to mix dry powder washes by hand. A mechanical mixer is always recommended for preparing solutions of paste type washes, the propeller type, turning at not less than 400 rpm, being preferable. It is essential in either case that the solution be smooth and entirely free of lumps.

Bentonite Is Suspension Medium

It is no secret that bentonite is the material that suspends all washes in water. It is a known fact that, when bentonite is mixed with water, an appreciable time must elapse before the solution becomes stable in consistency. In other words, the Baumé will increase until equilibrium is reached in the absorption of water by the bentonite. For this reason, dry powder washes, after being mixed with water, will show an increase in Baumé on standing. It is preferable to prepare a solution of dry powder wash an hour or so before using to allow the Baumé to become stable. Paste type washes, on the other hand, usually can be used immediately after mixing since the absorption of water by the bentonite has been brought to equilibrium in the manufacturing process.

Every foundryman who uses a core or mold wash wants to get the maximum in good results. Washes enjoy a unique position in foundry practice in that a properly selected wash used correctly can easily save several times its cost in reduced cleaning room cost, plus the undetermined, but nevertheless important, value of better looking castings.

Several years ago an investigation was carried out on the area of core surface that could be covered by one pound of dry wash, when used in a solution at 30° Baumé. Baked cores were accurately weighed, dipped in solutions of a number of core washes, dried in an oven and reweighed. Knowing the area coated, a simple calculation gave the number of square feet of core surface that would be covered per pound of dry wash. In every case the coverage exceeded 40 sq ft per lb, which means that a good sized casting would require only a few cents worth of wash. And how far would a few cents go in paying for cleaning of the casting if no wash were used?

Factors Affecting Wash Functions

Points covered in the following paragraphs are intended to clarify some of the factors that affect the action of core and mold washes. They must be considered in adopting a core and mold coating procedure that insures the washes performing the function for which they are formulated.

It is false economy for any foundry, where any appreciable quantity of wash is used, to take the stand that they cannot justify the purchase of proper mixing equipment. The cost of such equipment is returned many fold; first, because hand mixing is laborious and

expensive; second, because a hand mixed wash is never as smooth as a mechanically mixed wash, which is reflected in a poor coating on the core or mold, and third, because surface coverage and suspension are not as good when the wash is hand mixed. Therefore, the first recommendation is—always mix any core or mold wash by mechanical means.

Reference has been made to the propellor type mixer. The other most commonly used method employs a cylindrical tank having a vertical central shaft to which are attached arms or paddles. Mixing action can be intensified if stationary arms are attached to the inside of the tank, projecting into the wash solution at points between the rotating arms and pitched in the opposite direction. There is a tendency, in round tanks, for the mass of solution to rotate as a body, greatly decreasing the effectiveness of the mixing action and often creating a vortex in the center, which sucks air into the solution. To correct this condition, three or four angle iron baffles should be attached vertically to the inside of the tank.

Never mix a wash by starting with all of the water required to make up the solution to the Baumé at which it is to be used, unless, of course, the desired Baumé is 55 to 60° or higher. Hold back part of the water and make the initial mix at about 60° Baumé. When the solution is smooth and all lumps are broken up add the remainder of the water. By following this procedure wash solutions can be made much faster, and they will be smoother. If mixing capacity is limited compared with the volume of wash solution used, the batch can be made to 60° Baumé and diluted in the dip or spray tanks.

Determine Mixture for Each Job

It cannot be too strongly emphasized that the preparation and use of wash solutions be carefully standardized and controlled to insure uniform, trouble-free operation. It is recommended that, whether a new wash is used or whether the same wash has been used for years, a study be made to determine the best Baumé for each job.

It is a simple matter to mix a wash solution 6 to 8° Baumé above the consistency that is expected to produce the best coating and to dip a few cores. Then lower the Baumé, by the addition of water, by 2° steps until the coating is exactly right. Batch mixes can then be calculated in pounds of "as received" wash to gallons of water, and the mixes posted near the mixer. Degrees Baumé should also be posted, and every batch should be made up the same for the same job.

It is also advisable to check the Baumé of dip tanks during the day to further eliminate variations that can definitely cause trouble. Lack of control can easily result in a situation where the wash solution can vary from a thick consistency to that of dirty water.

Some foundries follow the practice of adding other solid materials to a wash as purchased. Such additions should not be made, unless absolutely necessary, because they disrupt the balanced characteristics formulated in the wash by the manufacturer. It may be that for most of the jobs in a foundry a low or medium priced wash is quite satisfactory, but one or two jobs are more severe in their action on the wash.

Plumbago is often added to a wash to increase heat resistance, and silica flour is sometimes added to open up the wash coating for easier torch drying. Additions of other materials may be safely made up to 10 to 15 per cent. Larger percentage additions affect the suspension and adherence of the wash to such a degree that bentonite and binder must also be added.

Most core and mold washes are used with water as the carrying liquid. Other liquids are frequently used to speed the drying of the coating, particularly on molds, and these liquids are organic solvents. If faster torch drying is desired the carrier liquid may be a mixture of an alcohol and water in various proportions. Such mixtures, unless the percentage of alcohol is high, do not support combustion by themselves, but do evaporate faster than water alone.

Using Inflammable Solvents

Some foundries use an inflammable solvent liquid with a relatively low flash point. The wash is mixed with this solvent, sprayed on the mold and the coating ignited. The heat generated by the burning solvent not only dries the wash film, but also gives the mold a slight skin dry below the film. Solvents other than alcohols do not mix with water and are used alone.

Where organic solvents are used extreme care must be taken, since they constitute a natural fire hazard. It is also very important that the solvent used have low toxicity in order to protect the operators from skin infection by contact with the solvent, and systemic infection from breathing the vapors.

One point that is frequently overlooked and sometimes misunderstood is the fact that core and mold washes which are formulated to be used with water will exhibit an entirely different effect when mixed with organic solvents. Two characteristics of the wash are so changed that extremely poor results may be obtained, and they are suspension and adherence.

Bentonite swells in water, absorbs water and suspends the particles of wash in water. It does none of these things in organic solvents. This means that, when any liquid other than water is used, the solution must be agitated continuously if any uniformity of coating is to result. Binders which are soluble in water are not soluble in solvents. Unless a binder is used that is soluble in the liquid used there will be little or no adherence of the wash film. Such a condition can result in the flowing metal washing off the film, leaving no protection and forming a rough casting surface.

Mention has been made of continuous agitation of wash solutions. Fortunately, modern formulation of core and mold washes, with their greatly improved suspension, eliminates the need for continuous agitation unless the wash is used at a very low Baumé. If agitation is necessary a mechanical agitator is much preferred to bubbling air through the solution.

Air Agitation Undesirable

Since one of the primary requisites of a wash is that its solution be free from air bubbles, which can cause rough casting surfaces, it is obvious that the introduction of air defeats the aim of both the manufacturer and user of a wash. Another objection to air agitation is the possibility of contaminating the solution surface with oil from the air compressor, unless an oil trap is installed in the air line.

It is the practice in some foundries to use a plumbago as a mold or core wash. Plumbagos usually do not contain either bentonite or binder since they are,

for the most part, used dry. It is, therefore, necessary to add bentonite if the plumbago is to remain in suspension, and binder if it is to adhere properly to the sand. Molasses water or glutrin water are the simplest materials to use for binder.

There is one point in the selection of a wash, for cores particularly, that is well worth comment. What yardstick should be used in comparing two or more washes that best measures their comparative economy? Many foundrymen believe that the most economical wash is the one that requires the least number of pounds of dry wash per gallon of water to make, let us say, a 30° Baumé solution.

Surprising as it may sound, it is possible to compound washes that require from 3 to 7 lb per gallon of water to make a 30° Baumé solution. Imagine the thickness of the wet film that must be dragged out of the solution when a core is dipped, when the solution contains only 3 lb of wash per gallon, yet the coating must be sufficient to produce clean casting surfaces. Imagine also the amount of water that must be evaporated in drying such a film.

The measure of economy of a wash is not its water absorption, not the specific gravity of the solution and not the drag out on the core. The only true measure of economy is the number of cores that can be satisfactorily coated with, say, 100 lb of "as purchased" wash. If a certain thickness of coating film and depth of penetration is required, then the most economical wash is the one with the lowest dry specific gravity.

This does not rule out the higher specific gravity washes because a wash that is a third heavier than another wash may give equal results when its film is one third thinner. When two or more washes have been compared for the number of like cores that can be coated with 100 lb, then, and only then, can the purchase price comparison be correctly made.

Summary

To summarize, the following recommendations are offered to enable foundrymen to obtain the best results from core and mold washes, at the lowest cost:

1. Always mix washes by mechanical mixer.
2. Standardize and control Baumé of all washes.
3. Unless absolutely necessary, do not add other materials to a wash as purchased, except wetting agents. By so doing the balance of characteristics so carefully formulated into it is destroyed.
4. If it is necessary to add more than 10 to 15 per cent of other materials to a wash as purchased, compensate by additions of bentonite and binder.
5. Clean mixing, dipping and spraying tanks and equipment periodically, more frequently in hot weather. By so doing the fermentation, crust build-up that breaks off and contaminates the solution, and accumulation of sand grains that make the coating rough will be prevented.
6. Do not expect any wash to correct poorly or improperly made cores or molds.
7. Determine the economy of all washes on the basis of cost of "as purchased" products per core, per mold or per casting.
8. For best results in selecting the proper wash for any job and in adopting the best practice for using a wash, consult the service engineers who represent the wash manufacturers.

Place Metal Castings History Book In California Schools And Libraries

DEVELOPMENT OF THE METAL CASTINGS INDUSTRY, recent A.F.S. publication by Bruce L. Simpson, president, National Engineering Co., Chicago, has been placed in schools and libraries throughout the Northern California chapter area by a number of foundries and suppliers. San Francisco area firms cooperating in this educational activity are: American Brass and Iron Foundry, American Foundry Equipment Co., Atlas Foundry and Mfg. Co., Brumley Donaldson Co., Columbia Steel Co., General Foundry Service Corp., General Metals Corp., Globe Metals Co., Illinois Cereal Mills, Inc., H. C. Macaulay Foundry Co., Pacific Steel Castings Co., Phoenix Iron Works, Vulcan Foundry Co., and Vulcan Steel Foundry.

DEVELOPMENT OF THE METAL CASTINGS INDUSTRY is $5.00 to A.F.S. members ($7.50 to non-members) and can be ordered from American Foundrymen's Society, 222 W. Adams St., Chicago 6, Ill.

Use Sponge Iron For Steel Scrap

SUCCESSFUL SUBSTITUTION OF SPONGE IRON for steel scrap in an electric furnace is reported in the U. S. Bureau of Mines publication R.I. 4305, *Gaseous Reduction of Iron Oxide Glomerules in a Shaft Furnace.*

Sponge iron production experiments carried out by Edward P. Barrett and Carl E. Wood at the Minneapolis Branch Office of the Bureau were witnessed by representatives of Dominion Foundries & Steel, Ltd., Hamilton, Ont. They arranged for the use of 3000 lb of sponge iron glomerules, being produced in the one-ton a day furnace, for an experimental heat.

Using a 2-ton electric furnace, Dominion Foundries charged 1600 lb of plate scrap on the bottom and banks and 2000 lb of sponge iron glomerules on the scrap. After partial melting, another 1000 lb of glomerules were added. Composition of the sponge iron was: total Fe 96.5%, O 3.4%, S 0.004% P 0.009%, SiO_2 0.18%. The charge included 50 lb of coke breeze.

Due to its low density and low carbon content the charge was difficult to melt. After melting the heat was worked normally for tin-plate steel and a 14 x 22 x 57 in. ingot was poured. Too much ferro-manganese was added so there was no rimming action. Absence of rimming is necessary for production of sound castings but a killed steel is not desirable for tin-plate. Specification for the steel was: C 0.06% max., Mn 0.30 to 0.40%, P 0.015% max., S 0.035% max.

In a remelt heat the ingot was cut into four pieces and charged into the furnace on top of 400 lb of plate scrap and 50 lb of coke breeze. A rimming steel was poured and the ingot was processed through the usual steps—hot rolling, black pickling, cold rolling, annealing, tempering, and tinning. The steel is reported to have been easier to cold roll than normal steel. The tinned sheets were satisfactorily fabricated into can bodies, crown caps, rings, and plugs.

From the experimental work done it is concluded: that iron oxide glomerules reduced with hydrogen are satisfactory material for the manufacture of electric furnace rimming steel; that sponge iron glomerules should be briquetted to increase their density; and that about 0.5 per cent carbon should be incorporated in the briquets to aid in melting.

Steam-cured coke briquets after removal from steam pressure cylinder are ready for loading from pallet cars into hopper-bottom railroad gondolas for delivery to foundry, where they are conveyed to fuel hopper.

BURN WASTE COKE IN CUPOLA

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COKE BREEZE is composed of the coke dust and fine material passing a one-inch screen. In the past, this coke dust generally was considered as waste material. A small amount was mixed with coal and used in firing boilers, but most of the coke breeze was hauled to the dump, which constituted a dead loss of at least 10 per cent of the foundry coke purchased.

Confronted by an ever-increasing amount of coke breeze, and its attendant disposal problem, the company's salvage engineer undertook to process this waste material into some form in which it could be used as cupola fuel. After many experiments it was decided that a coke briquet offered the greatest advantages. Several obstacles had to be overcome and, finally, the major problems were reduced to three:

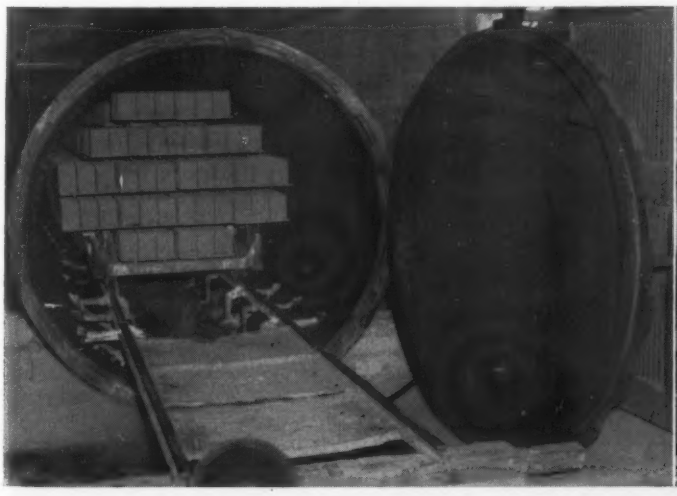
1. It was necessary to build a brick structure of such a nature that it would hold the cupola charge in relation to the melting zone and allow free burning.
2. Development of a binder which would withstand high temperatures and hold the particles together until complete combustion had been obtained.
3. An analysis such that the briquet would hold the required temperatures without a large amount of ash.

The first experiments with coke briquets were conducted in steel salamanders. The first tests were discouraging in that a wood fire would not ignite the briquets. However, when the briquets were added to a coke fire the results were more satisfactory, and still better when forced air was employed. This proved that the cope briquet was usable as a high ignition fuel, and laboratory tests showed that it contained as much as 70 per cent carbon, the amount depending directly upon the quality of the coke used.

In the first experiments it was found that the binder broke down prematurely, and also that the briquet would not stand mechanical handling. After further investigation it was decided that a brick 3½x4¾x 7¾ in. offered the greatest advantages. The binder used consisted of Portland cement and lime, giving the brick the desired strength and also acting as a flux. The cement and lime in the bricks supplemented to a considerable extent the limestone flux normally used.

In making the briquet, the following procedure was found to produce the best quailty: the coke breeze is passed between crushing rollers, which reduce the

Left—Coke briquets in high pressure steam cylinder for curing. After 4 hr under 250-lb steam pressure the briquets are ready for use in the cupola. Right—Carload of briquets ready for loading into fuel hoppers.



Dumping coke briquets into conveyor hopper for transfer to cupola fuel hoppers. They will be mixed with regular cupola coke in proportions of 10 to 30 per cent, and thus effect a saving of like amounts of fuel.

larger pieces to ¼ in., and then mixed with 5 per cent Portland cement and one per cent lime. Sufficient water is added to cause the particles to cling together under slight pressure, and a vibrating machine is employed to form the mixture into bricks. The briquets are then placed on pallet cars and rolled into a steam pressure chamber where they are subjected to a 250-lb steam pressure for 4 hr, after which they are ready for use. An interesting feature of the briquets is that they seem to improve in strength with aging, and can be stored indefinitely without deterioration.

At present the briquets are used in amounts of 10 to 12 per cent of the regular cupola coke charge. This is in almost exact proportion to the amount of coke breeze recovered. Tests have shown that the best results with the briquets are obtained in continuous cupola operation at 15 to 30 oz blast pressure. They do not work out efficiently when used as bedding coke or as split charges for noon-hour shutdowns.

During the winter the briquets are burned in salamanders with satisfactory results. Experiments indicate that the briquets can also be used in domestic coal-burning furnaces.

To date better than 1000 tons of briquets have been used in the company's cupolas. Every pound of coke purchased is used, and it is the briquet which makes this possible. Wider use and experimentation will, almost certainly, improve the briquet, although its present form is quite satisfactory for cupola use.

Industry Celebrates 60th Anniversary Of Pouring Of First Aluminum Ingot

REENACTMENT OF HISTORICAL HIGHLIGHTS in the development of aluminum were featured in a celebration held October 14 to commemorate the aluminum industry's 60th Anniversary. Held during the autumn meeting of the Aluminum Association, and under the auspices of the Historical Society of Western Pennsylvania, the ceremonies were staged on a replica of portions of the original plant of the Pittsburgh Reduction Co., where the industry was born. The celebration was attended by some 300 persons, including many of the industry's early leaders, as well as representatives of the Association's 36 member companies.

Henry Oliver Evans, president of the Historical Society, who served as master of ceremonies, outlined the historical highlights of the industry's first 60 years and introduced the other speakers: Roy A. Hunt, president of the Aluminum Company of America, whose father, Capt. Alfred E. Hunt, was founder and first president of the Pittsburgh Reduction Co.; and Arthur V. Davis, chairman of the board of Aluminum Company of America, who was one of the five original employees of the Pittsburgh Reduction Co. George H. Clapp, Pittsburgh philanthropist and one of the founders of the company, was also introduced.

Injecting many human-interest anecdotes into his address, Mr. Davis divided the early years of the aluminum industry into four periods—the "hard" period, when the question was "could we make aluminum?": the period during which the question was "what to do with the aluminum we have made?"; the period in which the keynote was "how to make some money out of the metal?": and the more recent years when the infant industry had attained its present position.

Following his address, Mr. Davis reenacted the pouring of the first ingot produced commercially by the

A. V. Davis, chairman of the board of the Aluminum Company of America, and one of the five original members of the Pittsburgh Reduction Co., re-enacts his part in the pouring of the first aluminum ingot produced by the electrolytic process in 1888 in a replica of the original plant. This ceremony was part of the 60th Anniversary Celebration held by the aluminum industry in Pittsburgh, October 14, during the autumn meeting.

lectrolytic process, just as he and Charles Martin Hall, inventor of the process, poured it in Nov. 1888.

The industry's 60th birthday was also the theme of the Aluminum Association's Autumn Banquet, held during the three-day meeting. In the feature address, Dr. Zay Jeffries, vice president of the General Electric Co., paid high tribute to the courage, vision and ability of the American pioneers of the Aluminum industry.

The meeting also included the regular fall sessions of the Association's board of directors and of its foundry, extrusion and sheet divisions.

TAKING GUESSWORK OUT OF FATIGUE ALLOWANCES

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FATIGUE ALLOWANCE granted to employees in compensation for lost time, due to physical tiredness, is a controversial subject among industrial engineers, and a source of ridicule and grievance among workers. This situation is further aggravated by the fact that many fatigue allowances have been established arbitrarily, with no basis for substantiation.

It is no longer necessary to guess at what a fatigue allowance should be for a certain occupation. The procedures used in point plan job evaluation can be carried over to the appraisal of the various fatigue factors within an occupation. All the benefits usually ascribed to improving rate alignment apply to fatigue allowances. The allowances can be considered fair and equitable for they have a reasonable and logical basis, and they can be explained in a manner that most workers appreciate.

When establishing a basis for fatigue allowances, it is a sound plan to appoint a committee of six at the start. One member should be responsible for gathering data, and the other members should assist in evaluating fatigue content. The opinions of a group are better than those of one man.

The first job of the committee is to select a series of not less than eight (8) key jobs within the foundry. The key jobs should include what is considered the most fatiguing and the least fatiguing occupations to which fatigue allowances will be applied; then between the extremes will be a number of occupations with varying fatigue content. The committee should appraise the list of key jobs and place them in rank order.

A representative key job list, ranked with the occupation having highest fatigue content first, might be as follows:

1. Squeezer molder operator, large work.
2. Chipping, large castings.
3. Flogging heads.
4. Swing grinding.
5. Stand grinding.
6. Squeezer molder operator, medium work.
7. Burn-off man, small castings.
8. Bench coremaker.

The committee should then determine what factors cause fatigue within the key occupations. Foundry

CHART 1—FATIGUE APPRAISAL CHART

I. Strength

A measure of the heaviest weight which must be lifted by an employee during his regular work. Where a hoist is used, the next heaviest object must be considered.

1. Over 150 lb.
2. 100 to 149 lb.
3. 75 to 99 lb.
4. 30 to 74 lb.
5. To 29 lb.

II. Monotony

Refers to the repetitiveness of work without changes in job.

1. Only one job a day, no changes.
2. More than one job, but not over four per day.
3. Usually four to eight different jobs.
4. Generally eight to 15 jobs a day.
5. More than 15 jobs per day.

III. Mental Strain

A measure of the employee's alertness due to danger, and the attendant nervous and mental strain. The required use of safety equipment is a guide to danger within an occupation.

1. Must use goggles and leggings during entire work cycle.
2. Must use goggles during entire work cycle.
3. Must use goggles, gloves, leggings, or other equipment during part of work cycle.
4. Must use protective equipment occasionally.
5. Never needs protective equipment on regular job.

IV. Units Handled

A measure of the units handled over a full working day, based on the average number of units per man.

1. 409 units and over.
2. 190 to 408 units.
3. 88 to 189 units.
4. 41 to 87 units.
5. To 40 units.

V. Noise

A reference to the volume and frequency of sounds due to equipment which is used by the employee on the job.

1. Constant loud noise, with very little relief.
2. Loud, shattering noise most of the time, but with some relief.
3. Some type of noise on the job, but not loud or shattering.
4. Loud, shattering noise intermittently.
5. Very little noise.

VI. Dirt

The amount of dirt to which employee is subjected over a full day's work.

1. Covers clothes and body. Dirt is of a clinging nature, and cannot be brushed off.
2. Covers face or hands mostly. Clings.
3. Nuisance dirt on clothes, face, or hands, but which can be brushed off easily.
4. Generally on hands only.
5. Very little dirt encountered.

CHART 2—FATIGUE FACTOR WEIGHT APPRAISAL

Job Title ..... Department ..... Date .....
Strength— Degree ..... Points .....
Monotony— Degree ..... Points .....
Mental Strain— Degree ..... Points .....
Units Handled— Degree ..... Points .....
Noise— Degree ..... Points .....
Dirt— Degree ..... Points .....
Job Grade ..... Fatigue Range ..... % to .....%
Total Points .....

CHART 3—FATIGUE APPRAISAL WEIGHT

Factor	Degree 1	2	3	4	5
Strength	300	240	180	120	60
Monotony ...	250	200	150	100	50
Mental Strain...	150	120	90	60	30
Units Handled..	150	120	90	60	30
Noise	100	80	60	40	20
Dirt	50	40	30	20	10

CHART 4—POINT VALUE—FATIGUE ALLOWANCE CORRELATION

Point Range	Per Cent
900-1000	33
810-899	30
725-809	27
654-724	24
587-653	21
529-586	18
476-528	15
428-475	12
386-427	9
To 385	6

work indicates a number of factors such as strength, monotony, mental strain, units handled, noise, and dirt. Other factors and other names for the same factors may be used; however, the important thing is that a clear-cut distinction exist between each factor. A degree of each factor should exist in each occupation.

Fatigue factors must be clearly defined. Each member of the rating committee should understand the definitions. Further, five degrees of each factor should be established so that it will be possible to tell which degree exists in an occupation. A sample set of defined factors and degrees may be seen in Chart 1.

The rating committee member who gathers information concerning occupations should have a simple form for making notes. In collecting his information, he can then look for the specific information needed. After appraisal of fatigue content, another one of the same forms can be used for the permanent file copy. All reasons for designating a certain degree of a factor, to a specific occupation, should be recorded. This information is often necessary for substantiating a rating, and for rating new occupations for which a fatigue allowance is needed. A form that serves this purpose is shown in Chart 2.

It is now possible for the committee to appraise fatigue content on all jobs which are to have a fatigue allowance. The tools are a set of defined factors, with varying degrees of the factor, and a write-up of each occupation showing what causes fatigue. It is a simple matter for the committee to complete this job phase.

Next, after appraising the difference in fatigue content of the occupations, a cross comparison of degrees should be made. The cross comparison is done by listing occupational titles vertically, and fatigue factors horizontally. Then the degree of each factor contained in an occupation is shown opposite the title and below the factor. Each appraisal of a degree should be questioned as to how it compares with other degrees on other jobs. The cross comparison is an overall check on judgement, and affords an opportunity for revisions when necessary.

Another job now confronts the committee. Point weights must be given to each factor and its degrees. The committee should determine which factor causes the most fatigue, and which the least. The factor which causes the most fatigue should be allowed the most points, for example, 900. The 900 points should then be broken down into five classes corresponding to the five degrees of the factor. The same procedure can be used in determining point weight for each factor used. It is important that different weight values be given the various factors in order to clarify the actual difference between fatigue factors, and degrees. A sample form is shown in Chart 3.

The point weights assigned to each degree should be marked on the form which shows substantiating information. The points per occupation are to be totaled.

Various industrial engineers who are in accord with the practice of making an allowance for fatigue state that a minimum of 6 per cent should be established. The maximum allowance has not been so clearly specified. If 33 per cent were determined as the maximum, a range from 6 to 33 per cent could be used. The range should be established by the committee prior to rating.

Total point values per occupation can be correlated with a fatigue allowance by means of a simple chart. Then it is necessary only to know the total points in order to determine the proper allowance (Chart 4).

While this method of determining fatigue allowances is quite lengthy when put into writing, nevertheless it is simple to explain, and is easily understood by workers. Guesswork is not needed in an application of fatigue allowances developed in this manner.

Sigma Phase Research Results Told By Illinois Institute of Technology

RESULTS OF RESEARCH ON SIGMA PHASE, a brittle compound formed by certain alloying atoms in steel subjected to high temperatures, were disclosed by scientists of the Illinois Institute of Technology October 28 at the joint convention of the American Society for Metals and the American Institute of Mining and Metallurgical Engineers, Philadelphia. Their findings are expected to find application in the construction of jet engines, whose performance depends upon the ability of their component metals to stand up under high temperatures.

The rate and amount of sigma phase formed during experiments was found to be influenced markedly by the amount of cold working—such as cold rolling, hammering and drawing—previously received by the alloys.

Three investigators also discovered that the presence of a structure called delta ferrite increases measurably the formation of sigma phase.

USING NON-FERROUS MELTING STOCK TO BEST ADVANTAGE

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IN NON-FERROUS METAL MELTING, there are two very good reasons for making the best possible use of raw materials. In the first place, American natural resources were greatly depleted by the war, and we are facing shortages of almost every metal. It is estimated that at normal peacetime consumption rate the commercial reserves of non-ferrous metals are: copper, 32 years, zinc, 17 years, lead, 10 years. Chromium, cobalt, nickel, tungsten, tantalum, and columbium are at present critical. Although aluminum ore is abundant there is insufficient water power to produce the primary metal from the ore. Only magnesium appears to be available in amounts in excess of usage requirements. The government must stockpile many metals because the only sources are foreign countries; for example, antimony from China, tin from the Orient and Bolivia. If war were to cut off transportation, the United States would be lacking in vital materials.

In the second place, metals are expensive. In many cases the cost of secondary metal is higher than the cost of primary metal. For example, nickel secondary material runs as high as 10 cents per pound over the primary metal, and aluminum secondary is selling for about 4 cents a pound more than primary aluminum, whereas secondary brass and bronze ingots are from 2 to 6 cents under primary metals.

"Primary" and "Secondary" Defined

In order to prevent misunderstanding, it would be be well at this time to examine two words that will be used frequently in connection with metals. Those two words are "primary" and "secondary." "Primary" is used to designate metal which is made from ore and which has not been previously melted or fabricated for commercial usage. "Virgin" is not a good term for this metal since so-called virgin tin may have as high as 1½ per cent antimony, and so-called virgin zinc may have appreciable amounts of lead. "Secondary" is used to designate metals which have been remelted and refined, derived principally from scrap.

In this paper it should be understood that the remarks are directed primarily, but not exclusively, to the small and medium sized foundries, since the very large foundries can maintain necessary accessory units such as smelting equipment, etc.

There are several ways, starting right in the shop, to make the best use of raw material. First of all, castings should be examined to see that they are properly gated. High rejection loss occurs from either underfeeding or overfeeding. If a casting can be saved, it conserves much raw metal, so improper gating should be corrected. One foundryman did reduce the size of gates and risers and was surprised at the thousands of pounds of metal he saved each month.

In the second place, the scrap should be segregated at the saws or machines whenever possible. Machine shops are noted for their poor segregation of turnings and borings. Do not put more than one kind of metal in each barrel, box, or bin. If it is intended to remelt the scrap, the metal is ruined if it is mixed, and if it is intended to sell the scrap to a secondary smelter, lack of segregation will lower the price received.

Mixing Scrap Lowers Value

It is possible to lower the price received for scrap as much as 1.5 cents per pound if it is not segregated. Why should this be, it may be asked, when the same number of chemical elements will be present whether the alloys are processed separately or mixed? That is true, but when the materials are mixed the whole batch may become contaminated with an element which in one metal is an alloying constituent, but in the other is an intolerable impurity. For example, if brass containing lead is mixed with non-leaded brass, none of the material can be used to make a non-leaded alloy.

There are several ways of helping to segregate scrap sprues. One method is to place the alloy number at several different locations on the gates by attaching small numbered strips on the pattern which will imprint on the sand the alloy number, or by placing similar markings in the permanent mold or die cavities. Another method is to use a variety of colored chalks or paints and mark each alloy a different color at the cutoff area, or prior to the cutoff if the castings are sufficiently cool.

In the third place, dross, skimmings, or grindings should not be discarded. A secondary smelter can often recover an amazing amount of metal from such materials. The foundry might not be able to use dross grindings, and skimmings because it is melting to pour castings, and time is important. The smelter can melt that material, pour ingots, and refine as many times as necessary because he has no molds waiting for metal. Furthermore, he can blend the recovered metal with other metal to obtain proper composition. To illustrate this point, consider the case of brass or bronze grindings and fine dross of low metallic content. The smelter will mix these with fluxes and fuel and sinter

Presented at the Metals Casting Conference, at Purdue University, LaFayette, Ind., Nov. 4-5, 1948.

them. Skimmings, slag, and the sintered grindings then are run through a blast furnace, which separates the metallics from the gangue. Metal from the blast furnace is run through reverberatory furnaces for further refining into alloy ingot. The foundry cannot go through this procedure in a normal melting cycle, since it would require smelting equipment. When such material is sold to the smelter, the price received will be based on the amount of metal recovered by smelting and refining.

To further show the value of saving all types of scrap possible, consider the case of nickel. The largest source of scrap at the present time is scrap anodes from plating works. Another very large source of supply is the filaments from radio cathode tubes. Normally, one would not even think that those small units would be worth saving, but they are most welcome to the smelters. Large amounts of nichrome scrap come from old heat-treat boxes.

While it is desirable to use back all of the shop scrap, this can be overdone. If melting is being done to make castings which will meet specifications for chemical analysis and/or physical properties, the following precautions should be observed:

1. Do not melt scrap of unknown composition. If scrap becomes mixed, either melt it down, pour ingots, analyze and remelt, making proper additions, or sell it to a secondary smelter. Whereas mixed scrap may badly contaminate a 1,000-lb foundry heat, it may cause very little trouble in a smelter's 60-ton heat.

Refining Is Costly

Remember also that mixed metal may result in an excessive amount of an element which cannot be tolerated if the metal is to meet requirements. Removal of such elements may require refining, which is not only costly but time consuming. For example, if copper alloy scrap becomes mixed so that the metal contains antimony, it is almost impossible to remove the antimony without first removing most of the tin, lead, and zinc present. Similarly, if aluminum becomes contaminated with magnesium, the magnesium may have to be removed by a costly refining process.

2. Oily or greasy scrap should not be melted unless smelting facilities are available. The material should be degreased or sold to a smelter. Oil or grease can cause gassy metal and rejected castings. Refining is required to remove the gas generated.

3. Do not melt turnings or borings unless smelting facilities are available. Unless melting is properly done, metal loss will be high and the resulting metal will be gassy. It is much better to sell the scrap to a smelter who can obtain maximum recovery and make the necessary refinement.

If scrap is being bought for foundry melting, it should be bought as ingot of known composition. Quite often smelters receive loads of scrap supposedly segregated and, in fact, it may consist of parts which appear to be the same; however, one smelter recently reported that it received a shipment of castings all supposedly of Navy "G" metal. All of the castings were exactly the same in size and design. Analyses of cuttings taken from some of the castings showed that there were four different alloys present.

There are other reasons, also, for buying ingot instead of scrap. Consider the form in which much of the scrap is available. For example, much scrap is too bulky for foundry melting. Large supplies of copper alloy scrap come from plumbing fixtures, aircraft accessories, and parts such as boilers and piping from decommissioned ships. In addition to being bulky, this type of scrap also has the other disadvantage of unavoidable contamination. For example, radiators may be 70 per cent copper-30 per cent zinc brass, and the tubes or honeycombs of relatively pure copper held together by any one of a number of tin-lead solders.

Another case would be more widely different alloys such as brass and babbitt or iron and babbitt bushings. The composition of these melted down would be unsuitable for foundry use, but could be refined and diluted by the smelter. Remember, the smelter has need for numerous alloys for his many customers, whereas each foundry normally has a much more limited number of alloys in which it can use mixed scrap.

Much aluminum scrap is available as aircraft propellers or structural parts. This scrap has much steel and copper fastened to it, not to mention rivets and numerous types of aluminum alloys. By use of a sloping hearth reverberatory furnace the foreign metals can be removed from the aluminum, but the process would hardly be feasible for foundry melting.

To further complicate the picture, the past 20 years has seen the development of numerous special purpose or high strength alloys containing elements not usually encountered. For example, beryllium, chromium, calcium, molybdenum, and silicon have been added to copper alloys. Similarly, tin, zinc, magnesium, and beryllium have been added to aluminum, and cerium has found use in magnesium. The presence of these elements is valuable to these special alloys, but might be poison if the usual alloys were contaminated with them. Buy ingots of known composition!

Purchasing Metal

Should primary or secondary metal be purchased? It does not matter in most cases, so the least expensive type that will answer the requirements should be purchased. If specifications must be met, order secondary to that specification. If the smelter can not meet the specification, primary can then be ordered.

Smelters now both smelt and refine. In one case, recently, a secondary metal producer made eight different analyses, using both wet methods and spectrograph, between the time the scrap was received and the time it was cast into ingots. The melting cycle was 48 hours, so there was ample time for refining and adjustment of composition.

If the foundry refines its own scrap, the following precautions should be taken:

1. Separate all iron from the scrap by magnetic separators.

2. Anything which was added to deoxidize the metal, such as phosphorus for copper alloys or magnesium for nickel alloys, can be removed by oxidation. Air is usually blown into the bath to accomplish this.

3. Undesirable impurities such as magnesium in aluminum can be removed by salt fluxes and/or the use of a chemically active gas such as chlorine. This process requires special fluxes and procedures and is not cheap, and metal losses are high.

4. Hydrogen pickup resulting from hydrocarbons such as oil or grease can be removed by proper fluxing.

5. Any readily oxidizable or volatile elements such as zinc, lead, magnesium, etc., must be compensated for during remelting by addition of the element.

6. Elements such as nickel and antimony in copper alloys or iron and silicon in aluminum alloys can be removed only by dilution. Unless the heats are large enough to effect dilution, it should not be attempted.

7. To smelt borings, turnings, or grindings, first get a molten bath using larger chunks of scrap, then gradually charge the fine material and push it under the molten metal bath; otherwise, losses will be high.

Handling Melting Stock

Now we have the ingot and scrap ready. What should we do from here on? To start with, if the raw material is aluminum, store it indoors out of the weather. Otherwise, it will oxidize and absorb moisture which will give gassy metal during melting and high metal loss, not to mention the spitting of molten metal that occurs when such material is placed in the furnace. If such aluminum cannot be stored indoors, heating it for a few minutes at 900 F will dry it effectively. Anodized metal also should be dried before use.

When melting both ingot and scrap, it is advisable to first charge and melt the scrap, and after this is molten add the ingot, which will then melt under the liquid metal and thus reduce oxidation loss.

Do not allow ingots to preheat in the furnace flame during melting. This will cause drops to melt off, each drop of which will have an oxide coating. This will not only add dross to metal, but will result in higher melting loss. Also, when the ingots are heated expansion occurs and the metal is able to absorb gases which are thus carried into the molten metal.

If sand is not removed from scrap before melting, it may result in silicon pickup, particularly in magnesium, whereas for copper alloys it will form a flux.

One very important factor in melting is to avoid overheating the metal. Not only will this cause high oxidation loss, but it may ruin the quality of the casting and cause it to be rejected. Rejected castings when remelted undergo further melting loss.

Metal can be degassed and fluxed to improve quality, but any such purification results in dross formation and loss of metal. Necessity of fluxing and degassing should be reduced to a minimum by good melting practice such as proper flame adjustment and avoiding excessive temperature or undue agitation of the metal.

To make best use of alloying additions they should be added in the form of hardeners or master alloys consisting of the base metal with high percentages of the alloying element. In this manner it is possible to accomplish more rapid alloying since less heat is needed for dissolving the hardener than would be required if the alloy addition were made as pure metal, especially with elements such as chromium, nickel, titanium, etc. Usually these additions are made shortly before pouring. Where oxidation or volatilization loss may be high, such as with magnesium, sodium, or calcium, additions should be made just before pouring.

Making Additions

Such elements are usually added in pure form and may be wrapped in foil and pushed under the metal, or they may be placed in a horizontal piece of pipe attached to a handle and thus plunged into the bath. Or they may be placed on the molten metal and quickly immersed by a plate shaped perforated plunger. The principal precaution is to see that the additions are rapidly immersed in the metal to prevent oxidation loss. Addition of elements which are likely to be removed during fluxing or degassing (such as sodium or magnesium) should not be made until after the fluxing or degassing. Do not guess at the amount of the alloying addition. Compute the weight required and then weigh it out.

Another way in which metal can be lost is through spillage during pouring. Locate molds so that the pouring men can easily reach the pouring sprue of each mold. Pour with lip of ladle as close to mold as possible. Teach pouring men to pour steadily and not in spurts which will overflow the mold. If choke gating is used where sudden choking may cause metal to splash, a pouring basin may alleviate this. Metal splashed on the floor easily becomes contaminated and quite often cannot be too well segregated, so it is much more economical to try to prevent spillage.

Selecting Alloys

Better use of raw materials can be effected by proper selection of alloys. Unduly restrictive specifications should not be applied unless necessary. It is not economically wise to use an alloy high in a critical or costly alloying element if a lower grade of alloy will do the job, nor it is wise to insist on metal of primary purity if secondary quality is adequate for the purpose.

For example, if pressure-tight bronze is required, the metal must not have aluminum, silicon, nor appreciable iron; but if strength is the only requirement, these impurities may be permitted. Since it is desired to conserve tin, an alloy of 81 per cent copper, 3 per cent tin, 7 per cent lead, 9 per cent zinc can be used in place of 85-5-5-5 (containing 5 per cent tin) and still maintain pressure tightness. As a matter of fact, lower tin content will increase creep strength.

Before the war aluminum alloy No. 12, containing 8 per cent copper, was the most popular secondary alloy. During the war it was found that the scrap was so mixed that alloys containing 4 per cent copper and 3 per cent silicon could be most economically made from it. Due to its good castability, that type of alloy has continued to be popular and can be supplied as secondary metal. Its properties are adequate for many uses which otherwise would require primary metal or higher grade secondary metal.

Specifications Standardized

Very substantial assistance could be given if specifications were standardized. At the present time we have government specifications of several kinds, not to mention tailor-made specifications from individual customers. This necessitates a number of variations of the same alloys, with sometimes only minor differences in composition. Standard specifications which would be used by all consumers would make the supplying of alloys much more flexible. Attempts are being made to bring this about. Wright Field has established a committee on Aeronautical Materials Specifications in conjunction with the Society of Automotive Engineers.

By adopting the initials of the committee, the specifications are known as AMS specifications. Many of the large producers and consumers are using these as standard specifications, and it is helping a great deal. Any prospective consumer should keep this in mind.

WHO'S WHO

W. A. Englehart

W. A. Englehart, co-author of *"Burn Waste Coke in Cupola,"* Page 59, has held executive sales and engineering positions in several Midwestern foundries and is today salvage engineer, Pontiac Motors Div., General Motors Corp., Pontiac, Mich. . . . A graduate of Purdue University, Mr. Englehart served his apprenticeship in the Erie Railroad's Machine Shop at Kent, Ohio . . . Joined the Engineering department of Premier Motor Co., Indianapolis, following his apprenticeship, later did engineering sales work for Lyons Atlas Engine Co. in that city . . . Has served consecutively in executive sales and engineering positions with Turner Mfg. Co., Grafton Foundry, and Cleveland Tractor Co., prior to joining Pontiac.

H. W. Arterburn

H. W. Arterburn, co-author with W. A. Engelhart of *"Burn Waste Coke in Cupola,"* Page 59, is general foreman of cupolas, Pontiac Motor Co. . . . Served his apprenticeship at Slinger Foundry Co., Slinger, Wis., afternoons and evenings under his father while attending high school . . . Joined American Metal Products Co., Milwaukee, as a coremaker during summer vacation, and in 1932 became cupola tender at West Specialty Co., Plano, Ill. . . . Joined Pontiac in 1935 as cupola foreman, is now general cupola foreman.

John R. Walley

John R. Walley, author of *"Taking Guesswork Out of Fatigue Essentials,"* Page 61 is supervisor of standards for the Ohio Steel Foundry Co., Springfield, Ohio. . . . Has studied time study and methods at Michael's School, Inc., Cincinnati, the University of Cincinnati and Miami University . . . Began as time study analyst with Harris-Seybold Co., Dayton, Ohio, in 1937 . . . Left there to join National Cash Register Co. in the same capacity in 1940-41 . . . Became methods engineer for Master Electric Co., 1943-46, and meanwhile served as motion and time study engineer for Standard Register Co., all of Dayton . . . Returned to Harris-Seybold as supervisor of standards in 1946, and was personnel director for the Duro Co., Dayton, prior to joining Ohio Steel Foundry Co. . . . Was a certified Training Within Industry trainer during the war.

Robert P. Schauss

Robert P. Schauss *(Controlling Malleable Sand Properties,"* Page 52) graduated from Case Institute of Technology in 1938 with a B. S. in Metallurgical Engineering . . . Awarded the Ferro Enamel Corp. Fellowship for investigating enameling characteristics of gray cast iron . . . Later joined Ferro Enamel as research metallurgist . . . Became chief metallurgist at the Cicero, Ill., plant of National Malleable & Steel Castings Co. in 1939, and, later, superintendent of the company's malleable foundry. Mr. Schauss joined Illinois Clay Products Co. this spring as foundry engineer, Western Area.

Hiram Brown

Hiram Brown, author of *"Using Non-Ferrous Melting Stock to Best Advantage,"* Page 63, besides being one of the foundry industry's most prolific writers and a frequent speaker before technical educational and civic groups, is vice-chairman of the A.F.S. Aluminum-Magnesium Division, chairman of the Program and Papers Committee, and a member of the Handbook Revision, Casting Stability and Recommended Practices Committees . . . Graduated cum laude in engineering from Fenn College, Cleveland, Ohio, Mr. Brown did graduate work in Industrial Management at Niagara and Cornell Universities—all while employed by the Aluminum Co. of America as technician . . . Is at present chief metallurgist, Solar Aircraft Co., Des Moines, Ia. . . . Author of *Aluminum and Its Applications,* published this year . . . He is a member of A.F.S., ASM, British Institute of Metals.

Sven H. Torreson

Sven H. Torreson, author of *"Using Structure Diagrams in Gray Iron Foundries,"* Page 40, is president of the Swedish Foundrymen's Association . . . A graduate of Tekniska Hogskolan, Stockholm, Mr. Torreson served his foundry apprenticeship in England and Germany . . . Is presently foundry manager of Sweden's A. B. Gotaverken at Gothenburg . . . Has spoken before several European technical societies on foundry practice, melting and metallurgy . . . He is vice-president of the Swedish Engineer's Ass'n. and president of the Swedish-American Ass'n.

Paul Von Colditz

Paul Von Colditz, author of *"Increasing Casting Yields—Production Steel Foundry Uses Exothermic Pipe Eliminator,"* Page 48, started with the Canadian Car & Foundry Co. as an apprentice in 1938 . . . Served from 1940-45 as an infantry captain in the Canadian Army . . . Saw active service in France and Germany . . . Returned to Canadian Car & Foundry after the war and is today foundry foreman at the Longue Point, Quebec, Works. . . . A member of A.F.S., Mr. Von Colditz recently spoke on the use of thermit pipe eliminator for steel castings at Eastern Canada & Newfoundland Chapter's 1948 National Officers' Night.

Dr. J. A. Ridderhoff

Dr. J. A. Ridderhoff *("Select Mold and Core Wash to Meet Casting Conditions,"* Page 55) holds an M.A. from Clark University, Worcester, Mass., and a Ph.D. from Brown University (1929) . . . A former DuPont Fellow, Dr. Ridderhoff has spoken before several A.F.S. chapters on core and mold washes and has authored papers on the subject for the technical press . . . Dr. Ridderhoff is manager of the Foundry Facings Department of Frederic B. Stevens, Inc., Detroit.

GRAY IRON FOUNDERS HOLD 20th CONVENTION

PRESENTATION OF ITS FIRST GOLD MEDAL and election of new officers were highlights of the 20th Annual Meeting of the Gray Iron Founders' Society, held October 14-15 in Atlantic City.

The Society's gold medal, the first in its history, was presented to Arthur E. Hageboeck, executive vice president of Frank Foundries, Inc., Moline, Ill., for "outstanding, unselfish service on behalf of the industry." Mr. Hageboeck, who served as president of the Society in 1931-32, vice-president in 1930; director, 1930-32, and chairman of the Society's Cost Committee since 1945, became the first recipient of the award for

Recipient of the first gold medal to be awarded in the history of the Gray Iron Founders' Society is Arthur E. Hageboeck, executive vice-president, Frank Foundries Corp., Moline, Ill., "for outstanding service to the Gray Iron Founders' Society and gray iron industry."

his tireless promotion of sound cost-accounting procedures; for his organizational accomplishment in establishing foundry cost groups throughout the country; and for his promulgation of successful merchandising methods in the foundry industry.

Other Society members honored by the presentation of illuminative, commemorative scrolls were: Howard A. Stockwell, Barbour-Stockwell Co., "for outstanding service to the Society as its president in 1947-48"; John M. Price, Ferro Foundry & Machine Co., for "exceptional leadership in connection with formation and financing of the Foundry Educational Foundation"; Arthur J. Tuscany, for "years of service as the Society's first general administrative officer"; and Philip Frankel, for "wise leadership and sound counsel."

Hermann P. Good, foundry superintendent, Textile Machine Works, Reading, Pa., was elected president of the Society at the Convention, succeeding Mr. Stockwell. John E. McIntyre, vice-president and general manager of the Sibley Machine & Foundry Corp., South Bend, Ind., was elected vice-president; Robert G. Schaefer, chairman of the board and treasurer, Schaefer-Goodnow Foundries, Inc., Pittsburgh, secretary; and Henry J. Trenkamp, president, The Ohio Foundry Co., Cleveland, treasurer.

Newly-elected directors of the Society are: H. L. Edinger, president, Barnett Foundry & Machine Co., Irvington, N.J.; J. W. Simmons, Jr., secretary-treasurer, Cox Foundry & Machine Co., Atlanta, Ga.; E. B. Sherwin, president, Chicago Hardware Foundry Co., Chicago; C. F. Scherer, president, Davenport Machine & Foundry Co., Davenport, Ia.; H. D. Caylor, president, C & G Potts & Co., Indianapolis; A. E. Thomas, president, Thomas Foundries, Inc., Birmingham, Ala.; and S. D. Russell, Phoenix Iron Works, Oakland, Calif.

Directors retained on the board are: G. F. Hutchins, II, treasurer, Standard Foundry Co., Worcester, Mass.; Messrs. Good, Schaeffer, Trenkamp and McIntyre.

Principal speaker at the two-day convention was William B. Given, Jr., president of the American Brake Shoe Co., New York City, who spoke on *"Rating Better People in Our Foundries,"* in which he emphasized the importance of long-range planning to develop an organization capable of attracting better personnel. Mr. Given cited good apprentice training programs, improved working conditions, better safety policies, labor-saving devices and research as important steps in making the foundry a better place to work.

In a symposium on foundry hygiene, Dr. L. E. Hamlin, medical director, American Brake Shoe Co.; Theodore F. Hatch, research director, Industrial Hygiene Foundation of America, Inc.; and Theodore C. Waters, partner, Mullikin, Stockbridge and Waters, Baltimore, Md., discussed silicosis in the foundry industry, improving foundry working conditions, and the legal aspects of compensating disability caused by silicosis.

John A. Claussen, American Iron & Steel Institute, speaking on *"The Pig Iron Situation—Past and Present"* predicted increased production of pig iron in the near future. Other speakers on the program were Former Governor Hoffman of New Jersey; Dr. R. S. Hartman, executive secretary, Council of Profit Sharing Industries; James H. Smith, general manager, Central Foundry Division, General Motors Corp.; and H. C. Nicholas, president, Quality Casting Co.

Odd Pig Iron Shipping Complications

FROM THE LOG of the pig iron shippers comes this pair of odd but true items, according to *Steel Facts* for October, 1948:

Before the war, small Swedish ships used to call at Great Lakes ports to pick up loads of pig iron. Huge magnets swung the pigs from the docks to the holds. Swedish skippers, after several confused ocean trips, began to insist on non-magnetic loading. The magnetized pig iron was playing hob with their compasses!

When most iron was shipped as sand cast pigs, railroads considered 2268 lb as a gross ton, instead of the regular 2240 lb. This allowed for sand adhering to the iron, which would be jarred loose in transit. With the advent of pig casting machines, contact of molten iron with sand was largely eliminated. Railroads and shippers made hasty readjustments back to the 2240 lb gross ton, the article in *Steel Facts* concludes.

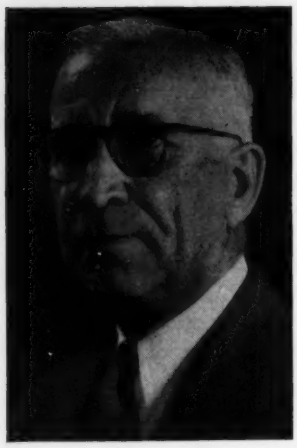
Magnesium Men Hold Mid-Year Meet

DISCUSSION SESSIONS with 100 per cent attendance and participation by everyone were a feature of the Third Mid-year Meeting of the Magnesium Association, held Oct. 13 and 14 at the Skytop Club, Skytop, Pa. Prepared papers are not presented at mid-year.

Letters to the Editor

Recommends Foundry Career

I have given up my work with the Semet-Solvay Co. and retired after 42 years of active service in the steel and foundry industry. It has been a grand experience and I am indebted to the industry for an interesting life and the opportunity of gaining many valuable friends. My principal regret will be in having to give up these associations. After my own experience,



Gordon C. Creusere, long time A.F.S. member and former director of the Detroit Chapter, has retired after 42 years in the metal castings industry here and in Brazil.

I very heartily recommend the foundry industry as a useful and desirable career for our young men of today.

My early metallurgical experience was in steel castings and ingot work as melter, steel maker, and melting superintendent. The Bessemer converter was our chief melting tool in the early days, followed by the open hearth and then the electric furnace. During this time much of my work was devoted to ingot steels and the development of sponge iron reduction on which I spent two years in Brazil.

On returning to the United States, I entered the gray iron field, holding various metallurgical positions in the automotive industry. For the past 10 years I have been consulting metallurgist on sales and service for Semet-Solvay.

I am making my home at 427 South M St., Lake Worth, Fla.

GORDON C. CREUSERE

Coke And Pig Scarce In Eire

We are gradually overcoming our many difficulties in the foundry end of our business. While we are unable to obtain coke and pig iron from Great Britain we have been successful in obtaining limited quantities of good quality materials from the Continent, although at considerably higher figures than those paid by competitive foundries in Great Britain.

We are, however, fortunate that we have plenty of good scrap available in the country, and this helps us to overcome our high cost of production. We increase the ratio of scrap to pig iron in our melts.

S. W. AITKEN, *Director*
Hammond Lane Foundry Co., Ltd.
Dublin, Eire

Look To 1950 A.F.S. Convention

At present it takes a long time to get anything done owing to shortages of steel, building materials, and even pig iron. We are forced to slow down instead of expanding to meet the increasing demand because pig iron is virtually rationed. However, we are hoping conditions will improve sufficiently to enable us to attend the A.F.S. Foundry Congress and Show in 1950.

ALEXANDER CARMICHAEL
Alexander Carmichael Pty. Ltd.
Sydney, Australia

Requests, Gets Correction

In my article *"Analyzing Malleable Iron—A Rapid Method for Cr, Si, and Mn Determinations"* which appeared in the September 1948 issue of AMERICAN FOUNDRYMAN, pages 56-58, there were two errors. In the table of solutions no volume was shown for the perchloric acid.

All the points on the graph that you show do not coincide with my graph. No point on my graph shows a variation greater than 0.008 per cent chromium.

W. B. SOBERS, *Met. Chem.*
Chain Belt Co.
Milwaukee

Corrected table and graph are printed below.

STANDARD SOLUTIONS

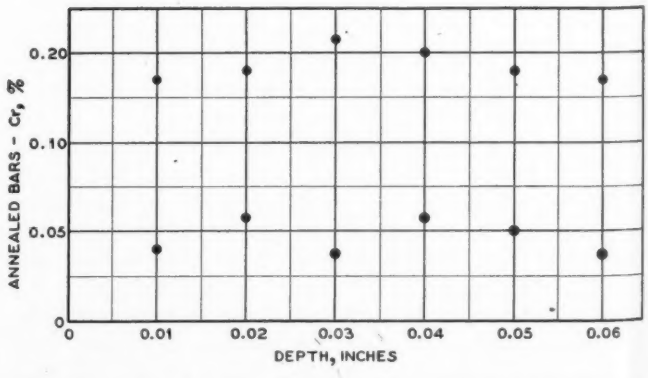
Dissolving Solutions

Water, ml	250
Nitric Acid, ml	250
Perchloric Acid (70-72%), ml	1000

Reducing Solution (Cr)

Ferrous Ammonium Sulphate, g	3
Water, ml	14
Perchloric Acid, ml	1

Transfer solution to a suitable dropping bottle so that 20 drops will approximately equal 1.0 ml, or be equivalent to 0.2000 g of the salt (1 drop equals 0.0100 g). Make fresh solution each week.



Graph showing effect of normal annealing cycle on amount and distribution of chromium in standard tensile bars containing from 0.05 to 0.20 per cent chromium in the hard iron state.

New AFS MEMBERS

Period September 15—October 15: Eight company members—six new and two conversions from personal membership—were added during this period. Chapters showing gains numbered 31 and a new student chapter was formed to give a membership increase of 192. Leading chapters were: Texas A. & M. Student Chapter (new), 19; Eastern Canada & Newfoundland, 19; Central Ohio, 13; Central Indiana, 11; Chicago, 11; Missouri Mines Student Chapter, 10; Northwestern Pennsylvania, 10; Quad City, 9; Southern California, 9; Saginaw Valley, 8.

CONVERSIONS

Personal to Company

Gregg Iron Fdry., El Monte California—Charles Gregg, Pres. (Southern California Chapter).

Montreal Bronze Ltd., Montreal, Que.—A. J. Moore, Dist. Mgr. (Eastern Canada Chapter).

NEW COMPANY MEMBERS

John Bean Mfg. Co., Belding, Mich.—Howard L. Wolf, Supt., (Western Michigan Chapter).

Davenport Besler Corp., Davenport, Iowa—Clifton M. Brooks, Supt. of Fdry. (Quad City Chapter).

Galeton Foundry Co., Inc., Galeton, Pa.—Thomas F. Jones, Mgr. (Central New York Chapter).

International Harvester Co., McCormick Works, Chicago—George R. Hendrickson, Fdry. Supt. (Chicago Chapter).

St. Thomas Bronze Co., Ltd., St. Thomas, Ont.—H. D. Williams, Dist. Mgr. (Ontario Chapter).

Sorel Steel Foundries Ltd., Montreal, Que.—D. E. Read, Gen. Mgr. (Eastern Canada & Newfoundland Chapter).

CANTON CHAPTER

Bert Arant, Dev. Engr., Titanium Alloy Mfg. Co., Pittsburgh.

CENTRAL ILLINOIS CHAPTER

Dwight L. French, Wood Patternmaker, Caterpillar Tractor Co., Peoria, Ill.
Clarence C. Schmidlin, 1005 S. Fell Ave., Normal, Ill.

CENTRAL INDIANA CHAPTER

Arthur C. Buesing, Plt. Mgr., The Williamson Heater Co., Greensburg, Ind.
Herman C. Hammer, Appr., International Harvester Co., Indianapolis.
Thomas G. Harvey, Met. Engr., Sonith Industries Inc., Indianapolis.
Lynn Johnson, Night Plant Supt., American Foundry Co., Beech Grove, Ind.
Ernest Mattingly, Frm., L. Stevens & Son, Inc., Indianapolis.
James McClain, Yard Supv., Swayne, Robinson & Co., Richmond, Ind.
Carl E. Miller, Gen. Frm., American Fdry. Co., Inc., Indianapolis.
Joseph A. Riczo, Cup. Operator, Sonith Industries, Inc., Indianapolis.
Vasant H. Shah, Student, Purdue University, Lafayette, Ind.
Rollin C. Smith, Engr., Federal Foundry Co. Div., American Stove Co., Indianapolis.
Robert Stevens, Vice-Pres., L. Stevens & Son, Inc., Indianapolis.

CENTRAL NEW YORK CHAPTER

***Thomas F. Jones, Mgr., Galeton Foundry Co., Inc., Galeton, Pa.**
Robert L. Folkman, Student, Cornell University, Ithaca, N.Y.
Thomas R. Jones, Appr., Galeton Foundry Co., Inc., Galeton, Pa.
Horace Stiles, Asst. Supt., Galeton Foundry Co., Inc., Galeton, Pa.

CENTRAL OHIO CHAPTER

Carol E. Abbott, Sr., Patt. Shop, Miller Foundry Co., Columbus, Ohio.
Daniel E. Armel, Office Mgr., Miller Foundry Co., Columbus, Ohio.
Eugene Baker, Chief Chemist, Dayton Malleable Iron Co., Ironton, Ohio.
Elwood Bowen, Melt. Supt., Ohio Steel Foundry Co., Springfield, Ohio.
Fred N. Davis, Fdry. Supt., Oliver Corp., Springfield, Ohio.
Paul E. Eubanks, Met, Ohio Steel Foundry Co., Springfield, Ohio.
Vernon Huff, Frm., Melting & Floor Molding, Miller Foundry Co., Columbus, Ohio.
O. K. Hunsacker, Engr., Dayton Malleable Iron Co., Ironton, Ohio.
James W. Leonard, Maint. Frm., Miller Foundry Co., Columbus, Ohio.
Rudy Markoch, Asst. Sand. Supv., Ohio Steel Foundry Co., Springfield, Ohio.
Steve Maynard, Maint. Frm. II, Miller Foundry Co., Columbus, Ohio.
Charles Morrison, Chemist, Dayton Malleable Iron Co., Ironton, Ohio.
Edwin F. Price, Engr., Dayton Malleable Iron Co., Ironton, Ohio.

CHESAPEAKE CHAPTER

Francisco J. Campi, Lt. Naval Architect, Argentine Navy, Virginia Beach, Va.
Joseph Feldman, Molder, Chambersburg Engineering Co., Chambersburg, Pa.
Library, Virginia Polytechnic Institute, Blacksburg, Va.

CHICAGO CHAPTER

***International Harvester Co., McCormick Works, Chicago (G. R. Hendrickson, Fdry. Supt.).**
Richard L. Ashbrook, Asst. Met., Armour Research Foundation, Chicago.
Rudolph Buchhaass, Supt., Christensen & Olsen Foundry Co., Chicago.
Carl Carlsen, Asst. Chief Prod. Engr., Whiting Corp., Harvey, Ill.
Huber Conrey, Appr., International Harvester Co., Richmond, Ind.
Robert M. Fitzgerald, Asst. Supt., Christensen & Olsen Foundry Co., Chicago.
Steven A. Koscielniak, Sand. Tech., Western Foundry Co., Chicago.
Joseph L. Rayniak, Gen. Plt. Supt., Johnson Motors, Waukegan, Ill.
Simon Ryan, Patt. Engr., Western Foundry Co., Chicago.
Gilbert H. Van Schaik, Sls. Engr., Whiting Corp., Chicago.
Sam Willeford, Supv., Quality Control, Chicago Steel Foundry Co., Chicago.

CINCINNATI DISTRICT CHAPTER

George Carmical, Maint., Frm., The Bardes Forge & Foundry Co., Cincinnati.
Stafford T. Lantz, Sls. Repr., The Chas. Taylor Sons Co., Cincinnati.
Harry R. Shick, Jr., Pres., The Ranson & Orr Co., Cincinnati.
Robert C. Shick, Vice Pres., The Ranson & Orr Co., Cincinnati.

DETROIT CHAPTER

C. R. Bratton, Works Mgr., The Celotex Corp., Detroit.
John Fitzgerald, Asst. Fdry. Engr., Ford Motor Co., Detroit.
H. E. Gravlin, Jr., Met., Ford Motor Co., Rouge Plant, Huntington Woods.

E. CANADA & NEWFOUNDLAND CHAPTER

***Sorel Steel Foundries, Ltd., Montreal, Que. (D. E. Read,, Gen. Mgr.).**
Roger Bilisle, Sand Supv., Sand Testing Lab., Canadian Car & Foundry Co. Ltd., Montreal, Que.
Henry A. Burton, Precision Tool Rm. Frm., Canadian Car & Foundry Co. Ltd., Montreal, Que.
Laurent Corbeil, Asst. Supv., Crane Co. Ltd., Montreal, Que.
Venant DeL'Etoile, Sand Mixer, Robert Mitchell Co., St. Laurent, Que.
K. J. Fiset, Asst. Mgr., Ind'l. Sales, Robert Mitchell Co. Ltd., Montreal, Que.
Roland Galarneau, Melt. Rm. Frm., Robert Mitchell Co., Ltd., Montreal, Que.
Cecil E. Gorman, Plant Engr., Macdonald Metals & Plastics Ltd., Waterloo, Que.
Craig W. Groves, Sales Repr., Robert Mitchell Co. Ltd., St. Laurent, Que.
W. M. B. Heggie, Clean. Shop Supt., Canadian Car & Foundry Co. Ltd., Montreal, Que.
J. Art. Heroux, Alloy Foundry Inc., Merrickville, Ont.
J. A. Lang, Asst. Gen. Supt., Crane Co. Ltd., Montreal, Que.
P. E. Lefebvre, Prop., Rigaud Foundry, Rigaud, Que.
Guy Lemieux Appr. Molder, Robert Mitchell Co., Ltd., St. Laurent, Que.
Eddy Moore, Supv., Crane Co. Ltd., Montreal, Que.
Constantine A. Sebistianowich, Asst. Met., Dominion Engineering Works, Lachine, Que.
Emihien Senecal, Frm., Robert Mitchell Co. Ltd., Montreal, Que.
John T. Shum, Sls. Repr., Robert Mitchell Co. Ltd., Montreal, Que.
Dr. Etienne J. P. Spire, L'Air Liquide Society, Montreal, Que.

EASTERN NEW YORK CHAPTER

James F. Keaveney, Test Asst., Boston & Maine R.R., Boston, Mass.

METROPOLITAN CHAPTER

Michael Gladstone, Pres., Centrifi-Cast Co., Inc., Seagate, N.Y.
James Edward Ziegler, Trainee, Cooper Alloy Foundry Co., Maplewood, N.J.

MICHIANA CHAPTER

Edward J. Wesolowski, Frm., G. I. Fdry., Oliver Corp., South Bend, Ind.

NORTHEASTERN OHIO CHAPTER

W. N. Mullane, Asst. Supt., Republic Steel Corp., Newton Falls, Ohio.
R. D. Owen, Div., Ind'l. Engr., Republic Steel Corp., Newton Falls, Ohio.

NORTHERN CALIFORNIA CHAPTER

Manuel Ferreira, Knute Palmquist Foundry, Oakland, Calif.
Melvin Lieberman, Co-Owner, Western Iron & Metal Co., Oakland, Calif.

NO. ILLINOIS & SO. WISCONSIN CHAPTER

Thomas Jones, Maint. Supt., Gunite Foundries, Rockford, Ill.

* Company Members

NORTHWESTERN PENNSYLVANIA CHAPTER

Vincent J. Bowen, Appr., Griswold Mfg. Co., Erie, Pa.
Harold L. Eichholtz, General Electric Co., Erie, Pa.
Albert Gable, Asst. Supt., Meadville Malleable Iron Co., Meadville, Pa.
Ray Hilton, Maint. Frm., U. S. Radiator Corp., Dunkirk, N.Y.
Lloyd Johnson, Meadville Malleable Iron Co., Meadville, Pa.
Kermit A. Lundell, Engr., Weber-Knapp Co., Jamestown, N.Y.
James R. Mountain, Appr., Griswold Mfg. Co., Erie, Pa.
M. Nordoogian, Fdry. Frm., Meadville Malleable Iron Co., Meadville, Pa.
Jack L. Schuldt, Plt. Engr., Griswold Mfg. Co., Erie, Pa.
Stanley A. Zukowski, Frm., Erie Malleable Iron Co., Erie, Pa.

ONTARIO CHAPTER

***St. Thomas Bronze Co., Ltd., St. Thomas, Ont. (H. D. Williams, Dist. Mgr.).**
Edward H. Dithridge, Supt., Port Hope Sanitary Mfg. Co. Ltd., Port Hope, Ont.
Beverly Hutton, Fdry. Frm., Port Hope Sanitary Mfg. Co. Ltd., Port Hope, Ont.
Roy Misener, Mold. Frm., Cockshutt Plow Co., Ltd., Preston, Ont.
Garfield Ramsay, Fdry. Supv., Clare Bros. & Co. Ltd., Preston, Ont.
William Ross, Fdry. Supt., Port Hope Sanitary Mfg. Co., Ltd., Port Hope, Ont.

OREGON CHAPTER

John E. Barrett, Frm. Pipe Shop, Rich Mfg. Co. of Calif., Portland, Ore.
Gwyn C. Lodwig, Fdry. Supt., Shofner Iron & Steel Works, Portland, Ore.
T. M. Tindall, Patt. Maint., Rich Mfg. Co. of Calif., Portland, Ore.

PHILADELPHIA CHAPTER

Clarence M. Bowers, Fdry. Frm., Fletcher Works, Inc., Philadelphia.
James M. Dallas, Field Engr., General Grinding Wheel Corp., Philadelphia.
Lawrence Patterson, Frm., Brass Foundry, Skillman Hardware Mfg. Co., Trenton, N.J.
Raymond J. Shire, Serviceman, The Tabor Mfg. Co., Philadelphia.

QUAD CITY CHAPTER

***Davenport Besler Corp., Davenport, Iowa, (M. J. Howe, Asst. Secy.).**
Clifton M. Brooks, Fdry. Supt., Davenport Besler Corp., Davenport, Iowa.
William J. Hannan, Riverside Foundry, S & W Corp., Davenport, Iowa.
John Knox McPherson, Engr., International Harvester Co., Rock Island, Ill.
Spencer S. Phillips, Asst. Fdry. Met., International Harvester Co., Rock Island.
Robert D. Potter, Appr., International Harvester Co., Rock Island, Ill.
A. W. Schuermer, Appr., International Harvester Co., Rock Island, Ill.
Harold A. Sharp, Fdry. Engr., Union Malleable Iron Works, East Moline, Ill.
Lawrence W. Wells, Asst. Frm., Fdry., International Harvester Co., Rock Island, Ill.

SAGINAW VALLEY CHAPTER

Roy S. Dahmer, Design Supv., Eaton Mfg. Co., Vassar, Mich.
George R. Frye, Methods Engr., Fdry. Div., Eaton Mfg. Co., Vassar, Mich.
Frank S. Grau, Prod. Mgr. & Purch. Agent, General Fdry. & Mfg. Co., Flint, Mich.
John R. Ikner, Supv., Chevrolet Grey Iron Fdry., General Motors Corp., Saginaw.
F. E. Lamb, Div. Comptroller, Central Foundry Div., Saginaw Malleable Iron Plant, Saginaw, Mich.
Clarence H. Larkin, Secy.-Treas., General Foundry & Mfg. Co., Flint, Mich.
Clarence W. Meyer, Central Foundry Div., Saginaw Malleable Iron Plant, Saginaw.
C. D. Tucker, Asst. Fdry. Supt., Bay City Div., Dow Chemical Co., Bay City, Mich.

ST. LOUIS DISTRICT CHAPTER

Paul H. Burg, Chief Insp., American Steel Foundries, East St. Louis, Ill.
Ernest W. Strauch, Fdry. Supt., U. S. Radiator Corp., East St. Louis, Ill.

SOUTHERN CALIFORNIA CHAPTER

Harry Burghdore, Salesman, Chamberlain Co., Los Angeles.
Don E. Erickson, Sales Mgr., Chamberlain Co., Los Angeles.
Roger Hageboeck, Lincoln Foundry Corp., Los Angeles.
W. B. McCartney, Jr., Salesman, Los Angeles Steel Casting Co., Los Angeles.
Franz C. Oharek, Co-Owner, Columbia Foundry Co., Los Angeles.
James A. Oliva, Salesman, Chamberlain Co., Los Angeles.
Charles E. Pretzinger, Sales Engr., Snyder Foundry Supply Co., Pasadena, Calif.
V. L. Rodriguez, Jr., Owner, Los Angeles Pattern Shop, Los Angeles.
Robert Campbell Smith, Field Edit., Jenkins Publications, Inc., Los Angeles.

TENNESSEE CHAPTER

Irvin H. Barrows, Chemist, Emerson P. Poste Chemical Engr., Chattanooga.
Ralph E. Durham, Mold. Dept., Wheland Co., Chattanooga.
Earl Lewis Hartman, Sand Control Tech., Combustion Engineering Co., Inc., Chattanooga.
Verlin L. Inman, Fdry. Frm., Wheland Co., Chattanooga.
T. A. Johnson, Supt.,, Sommerville Iron Works, Chattanooga.

TEXAS CHAPTER

Sidney E. Speed, Trainee, Texas Electric Steel Castings Co., Houston.

TRI-STATE CHAPTER

Willis H. Mook, Gen. Frm., Bethlehem Supply Co., Tulsa, Okla.
Charles D. Ross, Mgr., Nelson Electric Mfg. Co., Tulsa, Okla.

WESTERN MICHIGAN CHAPTER

***John Bean Mfg. Co., Belding Works, Belding, Mich. (Howard L. Wolf, Supt.).**
George A. Mills, Owner, Mills Mfg. Co., Muskegon, Mich.
Donald Orrin Runyan, Fdry. Tech. Appr., Centrifugal Casting Co., Muskegon, Mich.

WESTERN NEW YORK CHAPTER

John W. Temple, Met., American Magnesium Corp., Buffalo, N.Y.

WISCONSIN CHAPTER

Duane S. Bosma, Admin. Asst. to Supt. of Fdries., Bucyrus Erie Co., So. Milwaukee.
George Gibson, Sales, Donald Sales & Mfg. Co., Milwaukee.
Siegfried G. Greis, Owner, Metal Processing Co., Milwaukee.
Clem Linski, Asst. Prod. Mgr., Pelton Steel Casting Co., Milwaukee.
John B. Peaslee, Pres., Dunrite Industries Inc., Manitowoc, Wis.
Maurice B. Van Engel, Treas., Dunrite Industries Inc., Manitowoc, Wis.
George Ulezelski, Berlin Chapman Co., Berlin, Wis.
Carl J. Zilch, Asst. Chief Met., Bucyrus Erie Co., So. Milwaukee.

STUDENT CHAPTERS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Thomas J. McLaughlin

MISSOURI SCHOOL OF MINES & METALLURGY

Irving G. Betz
Robert M. Cage
Robert E. Hebert
George Henderson Kelley
John R. Salvaggi
James Edward Schaffrodt
Sidney Silver
Lowell T. Smith
Domonic A. Verive
John S. Winston

TEXAS A & M

Edward N. Baker
Arnold E. Baron
John G. Dial, Jr.
Allen C. Garner
Henry F. Hall, Jr.
Teddy R. Hancock
Victor C. Henkell
Shelby Ross Henson
Robert T. Holmes
Monroe F. Johns
Roy F. Knepper, Jr.
William Dallas Little
James A. McCulley
Charles M. Nettles
Clyde C. Spraggins
Uralde Stoermer
B. L. Stone
William E. Way
John A. Whitacre, Jr.

OUTSIDE OF CHAPTER

Gordon R. Rubel, Stud., Lehigh University, Great Neck, N.Y.

Argentina

Kurt Carlos Juan Stetphan, Tucuman No. 149, Buenos Aires.

Australia

Bruce Hugh Garnsey, Mgr., Quality Castings Pty. Ltd., Waterloo, N.S.W.

Chile

Orlando Gonzalez, Chief Engr., Compania Electro Metalurgica, S.A., Santiago.

England

Peter Beardsley Higgins, Dir. & Secy., Yorkshire Engrg. Supplies Ltd., Menston-in-Wharfedale, Yorks.
George William Quilter, Fdry. Supt., Messrs. Baker Perkins Ltd., Coulsdon, Surrey.
Capt. C. Stoch, Airfield, Millom, Cumberland.
Ronald Wainwright, Prod. Mgr., Firth-Vickers Stainless Steels Ltd., Sheffield, Yorks.

France

Societe de Chimie Industrielle, 28 Rue Saint-Dominique, Paris.

Spain

Agustin Plana Sancho, Indust. Military Engr., Instituto del Hierro y del Acero, Madrid.

Switzerland

Dr. Ernest Zingg, Chief Met., Sulzer Brothers Ltd., Winterthur.

* Company Members

NOVEMBER 18

DETROIT
Rackham Educational Memorial, Detroit
DR. MORRIS BEAN
Morris Bean Co.
"A New, Unique Core Practice"

NOVEMBER 19

TRI-STATE
Joplin, Mo.
LYLE L. CLARK
General Motors Corp.
"Cupola Practice"

BIRMINGHAM DISTRICT
Tutwiler Hotel, Birmingham
ALFRED BOYLES
U. S. Pipe & Foundry Co.
"Structure Control of Cast Iron"

WASHINGTON
Gowman Hotel, Seattle
W. W. LEVI
Lynchburg Foundry Co.
Subject to be announced.

TENNESSEE
Patten Hotel, Chattanooga
DR. RALPH L. LEE
Public Relations Department, General Motors Corp.
"Human Relations"

NOVEMBER 21

DETROIT
Horace Rackham Memorial Bldg.
R. G. MCELWEE
Vanadium Corp of America
"Inside the Cupola"
HAROLD N. BOGART
Ford Motor Co.
"Castings Vs. Forgings"
R. A. QUADT
Federated Metals Div., American Smelting & Refining Co.
"Better Aluminum Castings"

NOVEMBER 26

CHESAPEAKE
Engineers' Club, Baltimore
E. T. KINDT
Kindt-Collins Co.
"Pattern Engineering"

NOVEMBER 29

TIMBERLINE
Oxford Hotel, Denver, Colo.
ALBERT G. ZIMA
International Nickel Co.
"Modern Development of the Foundry Industry"

DECEMBER 1

TOLEDO
Toledo Yacht Club, Toledo
LESTER M. MERRITT
Ohio Industrial Commission
"Silicosis in the Foundry Industry"

DECEMBER 4

SOUTHERN CALIFORNIA
Rodger Young Auditorium, Los Angeles
CHRISTMAS PARTY

DECEMBER 7

MICHIANA
LaSalle Hotel, South Bend, Ind.
C. B. SCHUREMAN
National Lead Co.
"Foundry Sands and Materials Necessary for Good Foundry Operation"

DECEMBER 9

CENTRAL MICHIGAN
Columbia Hotel, Kalamazoo
CHRISTMAS PARTY

OHIO STATE UNIVERSITY
Industrial Engineering Bldg., University Campus
WALTER A. SICHA
Aluminum Company of America
"Aluminum Castings"

DECEMBER 10

METROPOLITAN
Essex House, Newark, N.J.
CHRISTMAS PARTY

DECEMBER 11

CENTRAL ILLINOIS
American Legion Hall, Peoria
CHRISTMAS PARTY

CENTRAL NEW YORK
Hotel Onondaga, Syracuse
CHRISTMAS PARTY

DECEMBER 14

EASTERN NEW YORK
Circle Inn, Lathams, N.Y.
CHRISTMAS PARTY

ROCHESTER
Seneca Hotel, Rochester
E. T. KINDT
Kindt-Collins Co.
"Coordinative Function of Pattern Equipment and Castings"

DECEMBER 15

MISSOURI SCHOOL OF MINES AND METALLURGY
Experimental Station, Rolla
STUDENTS' TECHNICAL PAPER PRESENTATION CONTEST

DECEMBER 17

CHESAPEAKE
Engineers' Club, Baltimore
LESTER B. KNIGHT
Lester B. Knight & Associates
"Modernization of Small Foundries"

A. F. S. Employment Service

To contact firms seeking personnel through "Help Wanted" items write to American Foundrymen's Society, 222 West Adams St., Chicago 6, designating Item Number and issue of AMERICAN FOUNDRYMAN in which published. A.F.S. Applicant Registration Form then will be sent to applicant for filling in and returning to A.F.S. Headquarters. The form will be sent by Headquarters to the firm whose name will be divulged to the applicant at the same time. All negotiations thereafter must be made between applicant and firm.

POSITIONS WANTED

PW101 — Core Room Superintendent: Foundryman with 14 years experience as core room supervisor and superintendent wants position as core room superintendent. Steady, dependable, best references. Familiar with large and small work in both gray iron and steel foundries.

HELP WANTED

HW504—Salesman: Leading manufacturer of foundry equipment wants salesmen. Applicants must have a thorough background of foundry engineering. Must have car for traveling. Territories open nationally. In reply specify territory desired and remuneration, and give complete background.

Publish Wage Report

PREVAILING WAGE RATES in the gray iron foundry industry make up a 95 page report issued by the Gray Iron Founders' Society, Inc. Entitled *Wage Rate Report for the Gray Iron Foundry Industry—July 1948,* the report includes summaries of wage rates, both average straight time and incentive earnings rates, for 52 regions throughout the United States. Average hourly earnings, compiled from data received from more than 500 gray iron foundries, are shown for 51 jobs.

FOUNDRY Personalities

R. A. Wilkie, formerly foundry metallurgist at the Deere & Co. Testing and Research Laboratory, Moline, Ill., recently accepted a position as general metallurgist with the American Radiator and Standard Sanitary Corp., Pittsburgh. Long a prominent member of the A.F.S. Chill Test Committee, Mr. Wilkie is a past chairman of the A.F.S. Quad City Chapter. A graduate of the State University of Iowa in 1928, Mr. Wilkie joined Chicago Malleable Castings Co. as a chemist upon graduation. In 1935 he was appointed foundry metallurgist for the John Deere Waterloo Tractor Works, Waterloo, Ia., and in 1941 was transferred in the same capacity to Deere and Co.'s Testing and Research Laboratory at Moline, Ill.

R. A. Wilkie

C. E. McMartin has been appointed sales engineer for the Riehle Testing Machines Division of American Machine and Metals, Inc., East Moline, Ill. Mr. McMartin will make his headquarters at 4508 Stonewall St., Downers Grove, Ill.

Paul Brainard, formerly assistant supervisor of Hoist Design for the Hyster Co., Portland, Ore., has been named head of the newly-created Hyster Engineering Standards Department. Under Mr. Brainard's direction, the new division will work toward the standardization of design and materials in Hyster's three factories, located in Portland, Ore., Peoria and Danville, Ill. It is also announced that **R. E. Stiegele** will handle special sales assignments at the Company's General Sales Department, Portland, and that **William Morrow,** formerly purchasing agent at the Danville plant, has been appointed chief accountant at the Portland headquarters.

Dr. Albert L. De Sy, professor and head of the department of metallurgy, University of Ghent, Belgium, is spending about six weeks in the United States comparing research results with leading investigators here. Originator of the electro-polishing method for metallographic specimens, he has been doing considerable work on basic linings for induction furnaces and vacuum melting, and has also been active in the field of iron containing nodular graphite in the as-cast condition. The work on nodular graphite is being done under the sponsorship of IRSIA—Institute for Scientific Research Applied to Industry and Agriculture—an organization made up of industrial and agricultural groups and the Belgian government. Prof. De Sy's visit to the United States is sponsored by IRSIA and by ATFB, the Belgian Foundrymen's Association.

At a meeting of the board of directors of the Alabama By-Products Corp., Birmingham, **H. M. Cowart,** formerly vice president and assistant secretary-assistant treasurer, was elected executive vice president and treasurer and a director of the company, succeeding the late H. L. Morrow. **Frederick G. Koenig, Jr.,** was elected assistant secretary and will retain his former duties as company attorney. **J. Elbert Johnson,** formerly sales representative, was elected assistant treasurer.

Dr. Karl T. Compton has resigned as president of Massachusetts Institute of Technology to accept the chairmanship of the Military Establishment's Research and Development Board. He succeeds Dr. Vannevar Bush.

Key. Co., East St. Louis, Ill., recently promoted **Fred B. Riggan,** formerly chief metallurgist, to the position of foundry manager and general superintendent. **Arnold Czechowicz** was appointed assistant foundry superintendent, and **Robert Jacoby** chief metallurgist.

F. B. Riggan

Alexander D. Barczak, formerly vice-president of the Bardes Forge & Foundry Co., Cincinnati, and chairman of the Cincinnati Chapter of the American Foundrymen's Society, was recently appointed plant manager of Superior Foundry, Inc., Cleveland. A graduate of the University of Detroit in 1935, Mr. Barczak joined the Chevrolet Gray Iron Foundry, Saginaw, Mich., where he conducted research on sand control. In 1942 Mr. Barczak joined Bardes as metallurgist in charge of metal and sand control, and became successively, foundry superintendent, plant manager and vice president.

A. D. Barczak

B. F. Bilsland has been promoted from manager of the Allis-Chalmers Chicago district to manager of the company's newly-formed Midwest region. Graduated with an M.E. degree from Purdue University, Mr. Bilsland has been associated with Allis-Chalmers since 1919 and manager of the Chicago district for the last 15 years. **J. C. Collier,** a graduate of North Carolina State College and an employee of Allis-Chalmers since 1916 succeeds Mr. Bilsland as district manager of the Chicago office, where he has worked since 1929.

Personnel changes affecting six employees in the Foundry Division of the manufacturing department of Caterpillar Tractor Co., Peoria, Ill., are: **John Nieman,** a former cooperative engineering student at Illinois Institute of Technology and who has 13 years' experience in pattern-making and design, has been appointed general foreman of the large core room, replacing **Robert Hodgson,** who recently left the company. **Clarence Turner** has been named foundry superintendent in charge of all foundry operations on the second shift. He is a Caterpillar foundry apprentice graduate and has had molding supervisory experience for several years.

The third shift general foreman's post has been assigned to **Russell Zimmerman,** who has been serving in the same capacity on the second shift. **Luke Gunn,** general foreman of small molding, and **Earl Biddison**, general foreman, have been appointed to be in charge of all molding operations on the first and second shifts, respectively.

Marvin W. Smith of Pittsburgh has been elected to fill the newly created post of executive vice-president of Baldwin Locomotive Works. He was also elected a director of Baldwin. Mr. Smith graduated from the engineering school of Texas A. & M. College in 1915 and immediately went to work for Westinghouse Electric Corp. He has been a vice-president and the chief engineering officer of Westinghouse for the past 10 years.

Ralph Kelly, president of Baldwin, has been granted a leave of absence for the remainder of his term of office so he will have more time for civic activities.

Frank G. Steinebach, vice president of the Penton Publishing Co., Cleveland, was elected chairman of the Munitions Board's Foundry Industry Advisory Committee at a meeting held September 29.

J. V. Millane, managing director, Malleable Castings Pty. Ltd., Marrickville, Australia, visited A.F.S. Headquarters recently. He is touring United States foundries to study production methods.

Ted Stevens, son of Clayton Stevens, Core Room foreman of Superior Foundry, Inc., Cleveland, and formerly stock room employee at Superior, holds the National High School 200 Yard Free Style swimming record, the International YMCA 440 and 220 Yard Free Style records, and is a member of the National High School 300 Yard Medley Relay Team and the All American Long Distance Team. Ted, who finished second to Olympic Star Norris of Harvard University in the National Senior Four-Mile Race this summer, took up swimming to overcome chronic illness during his boyhood and has only been in competitive swimming since 1944.

E. B. Forse, manager of the Refractories Division of the Carborundum Co., Perth Amboy, N.J., was appointed assistant vice president of the Carborundum Co., effective November 1. He is succeeded as manager of the Refractories Division by **C. E. Hawke,** formerly director of sales for the Carborundum Co. **E. R. Baxter** has taken over Mr. Hawke's position as director of sales and sales administration. He is assisted by **G. R. Rayner, Jr.,** who will be responsible for home office and district sales administration.

Raymond L. Collier, executive vice president of the Gray Iron Founders' Society, Inc., Cleveland, was recently elected a director of American Trade Association Executives, national professional organization of trade association managers, at its annual meeting in Chicago. A Phi Beta Kappa from Ohio State University, Mr. Collier has had 22 years experience in

(Continued on Page 90)

A.F.S. CHAPTER DIRECTORY

BIRMINGHAM DISTRICT CHAPTER
Secretary-Treasurer, F. K. Brown, Adams, Rowe & Norman, Inc.

BRITISH COLUMBIA CHAPTER
Secretary-Treasurer, L. P. Young, A-1 Steel & Iron Foundry Ltd.

CANTON DISTRICT CHAPTER
Secretary, Robt. L. Fasig, Ashland Malleable Iron Co.

CENTRAL ILLINOIS CHAPTER
Secretary-Treasurer, Vern M. Swango, Caterpilla Tractor Co.

CENTRAL INDIANA CHAPTER
Secretary, Jack Giddens, International Harvester Co.

CENTRAL MICHIGAN CHAPTER
Secretary-Treasurer, George Petredean, Calhoun Foundry Co.

CENTRAL NEW YORK CHAPTER
Secretary, David Dudgeon, Jr., Utica Radiator Co.

CENTRAL OHIO CHAPTER
Secretary, D. E. Krause, Gray Iron Research Institute.

CHESAPEAKE CHAPTER
Secretary-Treasurer, C. A. Robeck, Gibson & Kirk Co.

CHICAGO CHAPTER
Secretary, V. M. Rowell, Velsicol Corp.

CINCINNATI DISTRICT CHAPTER
Secretary, B. A. Genthe, S. Obermayer Co.

DETROIT CHAPTER
Secretary, J. N. Phelps, Vanadium Corp. of America.

EASTERN CANADA AND NEWFOUNDLAND CHAPTER
Secretary, J. G. Hunt, Dominion Engineering Works Ltd.

EASTERN NEW YORK CHAPTER
Secretary-Treasurer, Ugo Navarette, General Electric Co.

METROPOLITAN CHAPTER
Secretary, J. F. Bauer, Hickman, Williams & Co.

MEXICO CITY CHAPTER
Secretary, N. S. Covacevich, La Consolidada S.A.

MICHIANA CHAPTER
Secretary-Treasurer, V. S. Spears, American Wheelabrator & Equip. Co.

NORTHEASTERN OHIO CHAPTER
Secretary, R. D. Walter, Werner G. Smith Co.

NORTHERN CALIFORNIA CHAPTER
Secretary, Charles R. Marshall, Chamberlain Co.

NORTHERN ILLINOIS-SOUTHERN WISCONSIN
Secretary, F. W. Thayer, Gunite Foundries Corp.

NORTHWESTERN PENNSYLVANIA CHAPTER
Secretary, Reginald Harding, Pickands-Mather Co.

ONTARIO CHAPTER
Secretary-Treasurer, G. L. White, Westman Publications Ltd.

OREGON CHAPTER
Secretary-Treasurer, Geo. C. Vann, Northwest Fdry. & Fce. Co.

PHILADELPHIA CHAPTER
Secretary-Treasurer, W. B. Coleman, W. B. Coleman & Co.

QUAD CITY CHAPTER
Secretary-Treasurer, C. R. Marthens, Marthens Co.

ROCHESTER CHAPTER
Secretary-Treasurer, L. C. Kimpal, Rochester Gas & Electric Corp.

SAGINAW VALLEY CHAPTER
Secretary-Treasurer, Raymond H. Klawuhn, General Fdry. & Mfg. Co.

ST. LOUIS DISTRICT CHAPTER
Secretary, P. E. Retzlaff, Busch-Sulzer Bros.-Diesel Engrg. Co.

SOUTHERN CALIFORNIA CHAPTER
Secretary, J. E. Wilson, Climax Molybdenum Co.

TENNESSEE CHAPTER
Secretary-Treasurer, Herman Bohr, Jr., Robbins & Bohr.

TEXAS CHAPTER
Secretary-Treasurer, P. B. Croom, Houston Pattern Works

TIMBERLINE CHAPTER
Secretary, John W. Horner, Jr., Slack-Horner Brass Mfg. Co.

TOLEDO CHAPTER
Secretary-Treasurer, R. H. Van Hellen, Unitcast Corp.

TRI-STATE CHAPTER
Secretary, D. A. Mitchell, Progressive Brass Mfg. Co.

TWIN CITY CHAPTER
Secretary-Treasurer, L. K. Polzin, Minneapolis Chamber of Commerce.

WASHINGTON CHAPTER
Secretary-Treasurer, Fred R. Young, E. A. Wilcox Co.

WESTERN MICHIGAN CHAPTER
Secretary, S. H. Davis, Campbell, Wyant & Cannon Fdry.

WESTERN NEW YORK CHAPTER
Secretary, R. E. Walsh, Hickman, Williams & Co.

WISCONSIN CHAPTER
Secretary, W. W. Edens, Badger Brass & Aluminum Fdry. Co.

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STUDENT CHAPTERS

UNIVERSITY OF MINNESOTA *Secretary,* Harvey Sauby

MISSOURI SCHOOL OF MINES *Secretary,* Martin L. Slawsky

OHIO STATE UNIVERSITY *Secretary-Treasurer,* Eldon Boner

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Secretary-Treasurer, Martin J. O'Brien

OREGON STATE COLLEGE *Secretary,* John P. Meece

UNIVERSITY OF ILLINOIS *Secretary,* Robert W. Bales

TEXAS A & M COLLEGE *Secretary,* Victor C. Henkel.

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CHAPTER ACTIVITIES NEWS

Northern California

Jack F. Mainzer
Pacific Brass Foundry
Publicity Chairman

"DEVELOPMENT of the Metal Castings Industry" was the subject of an address by A.F.S. National Director Bruce L. Simpson, National Engineering Co., Chicago, at the first regular monthly meeting of the Northern California chapter's 1948-49 season, held at Plands Broadway, Oakland, September 15. Chapter President George MacDonald, Macauley Foundry Co., presided.

Mr. Simpson's topic was the same as that of his book. His highly interesting talk was profusely illustrated with lantern slides. Following his address, Mr. Simpson autographed many volumes of his book purchased by chapter members. In addition to the books purchased for personal libraries, the following concerns bought books to be placed in California schools and libraries:

American Brass & Iron Foundry, American Foundry Equipment Co.; Atlas Foundry & Mfg. Co., Brumley Donaldson Co., Columbia Steel Co., General Foundry Service Corp., General Metals Corp., Globe Metals Co., Illinois Cereal Mills, H. B. Macauley Foundry Co., Pacific Steel Castings Co., Phoenix Iron Works, Vulcan Foundry Co., Vulcan Steel Foundry.

All books will be suitably inscribed with a book plate stating that the volume was presented by the Northern California Chapter of the American Foundrymen's Society, through the courtesy of the donor company. It was announced that additional books for this purpose could be purchased by calling the chapter secretary.

Prior to Mr. Simpson's address, Entertainment Committee Chairman Jay Snyder, Keenan Abrasive Division, Joseph Musto Sons, awarded two door prizes. The first, a pair of season tickets to Golden Gate Fields, went to S. D. Russell, Phoenix Iron Works, and the second was a pair of tickets for the Forty-Niners vs. Dons football game, awarded to Robert Lauten, General Metals Corp.

Program Chairman John Russo, General Foundry Service Corp., announced that the coffee speaker of the evening, Coach Buck Shaw of the San Francisco Forty-Niners could not be present, and expressed Mr. Shaw's regrets.

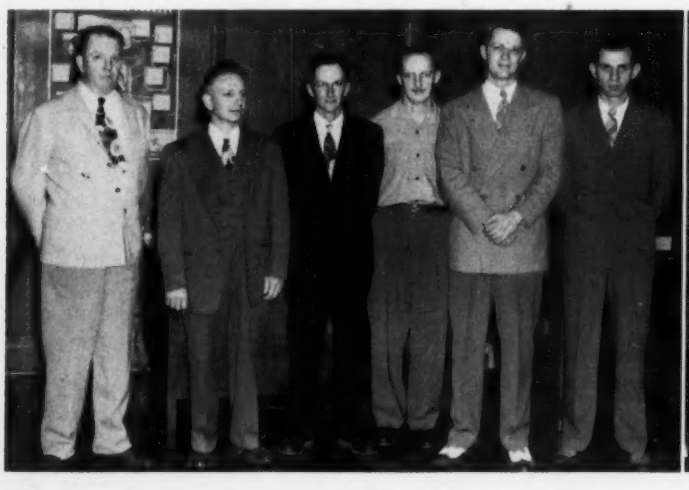
Chairman George MacDonald introduced the newly-elected chapter officers and directors and committee chairmen to the membership.

Central Illinois

V. W. Swango
Caterpillar Tractor Co.
Chapter Secy.-Treas.

OVER 100 MEMBERS AND GUESTS at the Chapter's first meeting of the season, held at the Jefferson hotel, Peoria, October 4, heard F. G. Steinebach, vice president, Penton Publishing Co., speak on "The Foundry Industry."

The end of the war, Mr. Steinebach said, left foundries stronger in experience and with more facilities than ever before. However, then as now, the main problem of most foundries was shortage of material and manpower. The material problems were partially brought about by the great loss of metal taken out of circulation during the war. Because of the continued shortage of pig iron and coke, Mr.



Oregon Chapter's new and old Boards. Left, the 1947-48 officers and directors. Left to right: H. L. Tatham, Pacific Steel Foundry Co.; S. E. Peeler, Electric Steel Foundry Co.; J. O. Grant, Electric Steel Foundry Co., retiring vice-chairman; H. K. McAllister, Western Foundry Co.; W. R. Pindell, Northwest Foundry & Furnace Co.; A. B. Holmes, Crawford & Doherty Foundry Co., secretary-treasurer. Not present are Retiring Chairman A. R. Prier, Oregon Brass Works; L. E. Holcomb, Crawford & Doherty Foundry Co.; and L. E. Bufton, Silica Products of Oregon. Right, the 1948-49 officers and directors. Back row, left to right: H. L. Tatham, H. A. Story, Oregon Brass Works; H. K. McAllister, A. B. Holmes. Seated, left to right: Vice-Chairman C. Neal Wilcox, Chairman J. O. Grant, Secy-Treas. G. C. Vann, Northwest Foundry & Furnace Co.

This happy and relaxed group of Alabama foundrymen photographed at the Birmingham District Chapter's 15th Annual Outing at the Roebuck Country Club, Birmingham, September 11, are, left to right, Biddle Worthington, American Cast Iron Pipe Co.; J. A. Morgan, Emory Pipe & Foundry Co.; Chapter Chairman J. T. MacKenzie; and Fred K. Brown, Adams, Rowe & Norman. (Photo courtesy Wm. McCullough, American Cast Iron Pipe Co.)

Steinebach said, foundries must analyze their practices with a view to conserving as much material as possible. The various foundry societies have duties to perform in interesting people in foundry work, so that manpower problems can be improved. The foundries themselves must hold down the cost of castings so that they can compete with other forms of fabrication, by using better production control, and by any other means possible.

Since the last war, Mr. Steinebach stated, a National Castings Council has been formed. One of this body's main functions will be to coordinate efforts of the various branches of the foundry industry, and to keep problems of the foundry constantly before Government executives, in order that industry problems be recognized.

In closing Mr. Steinebach remarked that the founder not making the best casting he knows how is not being fair to himself, his company, community or Government.

The next meeting of the Chapter will be held November 1 at the Jefferson Hotel, Peoria, with W. M. Ball, R. Lavin & Sons, Chicago, who will speak on "Non-Ferrous Foundry Practice."

Western New York

Roger E. Walsh
Hickman, Williams & Co., Inc.
Chapter Secretary

SEVERAL YEARS OF HIGH production for American business were predicted by Edwin J. Schwannhauser, vice president, Worthington Pump & Machinery Corp., Harrison, N.J., principal speaker at the Chapter's first meeting of the season, October 1.

In opening his address, Mr. Schwannhauser stated that, in his opinion, a change of administration will have no effect on the business outlook of the nation. Without posing as a prophet or an economist, he said, and looking at business from the long-range view, he stated his reasons why there should be several more years of high production in such basic industries as steels, railroads, automobiles, construction and utilities.

In outlining what he called the short range view, Mr. Schwannhauser said that he believes business is reaching a leveling off or readjustment period, but that things will move sideways rather than backwards.

In concluding his talk, Mr. Schwannhauser stated that this country had started with nothing just 175 years ago, and today is the most powerful nation in the world. He mentioned that Europe has nothing we want, and said that it is beyond all comprehension how anybody could think of such a thing as a Communistic government in the United States.

During the dinner and social hour preceding Mr. Schwannhauser's address, Chapter Chairman Martin J. O'Brein, Jr., Symington Gould Corp., presented Max T. Ganzauge, superintendent of foundries, General Railway Signal Co., Rochester, chairman of the Rochester Chapter of A.F.S.

Quad City

C. R. Marthens
Marthens Co.
Chapter Secretary-Treasurer

"CUPOLA MELTING CONTROL," an address by W. R. Jaeschke, consultant, Foundry Equipment Division, Whiting Corp., was featured at the chapter's first meeting of the year, held September 20 at the Fort Armstrong Hotel, Rock Island, Ill. About 125 members attended the dinner and technical session which followed. Chapter Chairman Martin H. Liedtke, International Harvester Co., presided and introduced the speaker.

Mr. Jaeschke used slides to explain the theory and results developed in research on various methods of cupola melting. He showed

Foundryman Fritz Rauschenberg's actions attest to the quality of the real Southern barbecue served at the Birmingham District Chapter's Outing, September 11. (Photo courtesy Wm. McCullough, American Cast Iron Pipe Co., Birmingham).

Photographed during the dinner preceding the opening meeting of the Northeastern Ohio Chapter, held September 9 at the Cleveland Club, are, left to right: Past President H. C. Gollmar, Elyria Foundry Div., Industrial Brownhoist Corp.; Chapter President Walter E. Sicha, Aluminum Co. of America; and Speaker L. P. Robinson, Werner G. Smith Co. (Photograph courtesy of Sterling Farmer of Sand Products Corporation, Cleveland).

several ways of obtaining closer control of melting through proper selection of charging equipment and materials. Discussion by members brought out many methods of overcoming poor quality of materials by the selection of better melting and charging equipment.

Twin City

O. J. Myers
Werner G. Smith Co.
Chapter Reporter

INAUGURATING THE 1948-49 season, nearly 100 members and guests heard F. G. Steinebach, vice president, Penton Publishing Co., speak at the October 7 meeting, at the Covered Wagon, Minneapolis.

Sheldon V. Wood, A.F.S. Past National President and an active member of the chapter, introduced Mr. Steinebach, who delivered a speech outlining the past, present and future of the industry.

Mr. Steinebach stressed the necessity for every foundry to keep its costs to a minimum. If foundry costs soar much higher, he said, substitutes will be used more and more.

The speaker stressed the need for constant vigilance over production control—when production control has been achieved it will herald an era of uniform castings and good will on the part of all customers.

Mr. Steinebach traced the growth of the foundry industry from the beginning of World War II to the present. He said that this is "just the beginning" of foundry development, and cited the "push-button" foundries now under construction.

The war aided the foundries in modernization and mechanization, in the pursuit and attainment of technical knowledge, and in a great deal of cooperative effort. He concluded by urging each foundryman present to ask himself the question "Am I making the best casting I know how?"

Metropolitan Chapter

George Baer
Atlas Foundry Company
Publicity Chairman

OTHER METHODS OF MANUFACTURE have been and are being developed to replace parts and assemblies which have traditionally been made as castings in the past, Harold Bogart of Ford Motor Company, Dearborn, Mich., warned members of the Metropolitan Chapter at its meeting on October 4.

The chapter met for the opening session of the 1948-49 season at the Essex House, Newark, N.J., with John A. Bukowski of Worthington Pump & Machinery Corp. presiding. Norman A. Birch of American Brake Shoe Co., Mahwah, N.J., was technical chairman.

As an outstanding example, Mr. Bogart cited the use of fabricated shapes and brazing in the construction of the cylinder block of a low priced automobile, a part of the automotive engine which has always been made as a casting.

On the other hand, he said, it is necessary for the foundryman to

At the speakers' table at the Wisconsin Chapter's first meeting are, left to right: Past Chapter President R. J. Anderson, Belle City Malleable Iron Co.; Chapter President R. C. Woodward, Bucyrus-Erie Co.; Chapter Vice-President Arthur C. Haack; and Chapter Secretary W. W. Edens, Badger Brass & Aluminum Foundry Co.

All set for the horseshoe pitching tourney are these foundrymen at Central Indiana Chapter's picnic.

train the engineer and designer to use castings in place of parts generally made by other methods, when the properties and economics warrant such a substitution.

In a comprehensive lecture liberally illustrated with slides, Mr. Bogart discussed the wide variety of castings made by Ford Motor Co. and their method of manufacture. He impressed the audience with the high degree of mechanization and wide variety of methods utilized in the Ford plant.

Making use of static, centrifugal, permanent mold, die, and plaster casting methods in the manufacture of gray iron, malleable iron, semi-steel, steel, and non-ferrous castings, Mr. Bogart illustrated the part that each method and type of material plays in the production of automotive products.

Outstanding among developments which have advanced manufacturing techniques are the short time annealing cycle for malleable castings, the use of centrifugal casting for gears, sprockets, cylinder barrels and other parts, the use of welded assemblies of castings and fabricated shapes in combination, and the use of stacked dry sand cores for the casting of crankshafts which outwear the traditionally used forged crankshafts and are made at lower cost.

Washington

Edward D. Boyle
Puget Sound Naval Shipyard
Chapter Vice Chairman

"DEVELOPMENT of the Metal Castings Industry" was the title of a lecture based on the book of the same name, given by A.F.S. National Director Bruce L. Simpson, National Engineering Co., Chicago, before the September 17 meeting, held at the Gowman hotel, Seattle.

At the opening of the meeting a telegram was received from Mr. Simpson stating that due to a train delay, he would be two to three hours late. In the interim, Edward J. McAfee, master patternmaker, Puget Sound Naval Shipyard, spoke on the use of plastic coating on wood patterns.

Prof. Gilbert S. Schaller, head of the University of Washington's School of Engineering, took the floor pending Mr. Simpson's arrival and delivered a witty and extemporaneous talk on foundry conditions in the Northwest.

Bruce Simpson, by taking a taxi from Portland, Ore., to Seattle, arrived much earlier than expected and immediately launched into an extremely interesting resume of the historical data compiled for his recently-published DEVELOPMENT OF THE METAL CASTINGS INDUSTRY.

Mr. Simpson covered the historical highlights of the foundry industry from a period some thousands of years B.C. to the present. The historical facts he presented were interspersed with several curious and amusing sidelights on the ancient art of founding.

St. Louis

Paul C. Schwarz
American Brake Shoe Co.
Publicity Chairman

"FOUNDRY MODERNIZATION, Design and Maintenance," by E. E. Ballard, Lester B. Knight & Associates, Chicago, was the featured address of the chapter's first meeting of the season. Mr. Ballard, who

John Williamson (left), M. A. Bell Co., technical chairman, introduces Speaker E. E. Ballard, Lester B. Knight & Associates, a past chairman of the chapter at the first fall meeting of the St. Louis District Chapter.

At the speakers' table at the September 20 meeting of Quad City Chapter were, right to left: W. E. Jones, Federal Foundry Supply Co.; Vice-Chairman E. P. Closen, John Deere Planter Works; Chairman M. H. Liedtke, International Harvester Co.; The guest speaker of the evening, W. R. Jaeschke, Whiting Corp.; C. S. Humphrey, C. S. Humphrey Co.; C. L. Briceland, J. I. Case Co.; J. H. Nelsen, Mississippi Foundry Co.; A .D. Matheson, French & Hecht; and Chapter Secretary-Treasurer C. R. Marthens, Marthens Co.

served as chairman of this chapter several years ago before leaving St. Louis, presented a highly informative outline of the basic concepts of foundry modernization.

Following Mr. Ballard's talk, G. H. Rohling, assistant personnel director of the Aluminum Ore Company of East St. Louis, provided 45 minutes of hilarious discussion on the subject of "pre-fabricated holes." He was introduced to the chapter as founder, co-owner and president of "Pre-Fabricated Holes, Incorporated."

Ohio State University

A. E. Stoner
Chapter Secretary

NEWLY-ELECTED CHAPTER officers, announced at the October meeting of the Ohio State University Student Chapter are: Chairman, Thomas Dole; Vice-Chairman, H. J. Gonya; and Secretary-Treasurer, A. E. Stoner.

Some 40 members and guests attended the meeting and heard L. P. Robinson, sales manager, Core Oil Division, Werner G. Smith Co., give a humorous account of his experiences in the poultry business.

The November 2 meeting was devoted to the assignment of duties for the OSU Student Chapter's part in the Ohio Regional Conference of the American Foundrymen's Society, to be held March 11 and 12.

Central Michigan

Arthur J. Stone
Albion Malleable Iron Co.
Chapter Reporter

"HUMAN RELATIONS" was the subject of an address by Dr. Ralph L. Lee, Department of Public Relations, General Motors Corp., speaking before the chapter's first meeting of the 1948-49 season, held September 21 at the Parker Inn Hotel, Albion. Retiring Chairman Douglas J. Strong, Foundries Materials Co., opened the meeting with an announcement of the new chapter officers and directors, and turned the meeting over to incoming chairman C. C. Sigerfoos, Michigan State College.

Following Mr. Sigerfoos' acceptance speech, Secretary-Treasurer George Petredean, Calhoun Foundry Co., presented a gift from the chapter to Mr. Strong for his work as chapter chairman during the past year. Mr. Sigerfoos announced the committee chairmen for the coming year, and turned the meeting over to Technical Chairman Jack F. Secor, Hill & Griffith Co., who introduced the evening's speaker, Dr. Lee.

Dr. Lee discussed the foibles of human behavior and outlined several basic factors to be applied in establishing better relations between personnel and management. Dr. Lee illustrated each of these factors with pointed anecdotes taken from his own experiences.

Central Indiana

William K. Mitchell
L. W. & W. K. Mitchell Co.
Chapter Reporter

"CORRECT CUPOLA PRACTICES" was the subject of the Central Indiana Chapter's first 1948-49 meeting speaker, Ford R. Snyder, Hickman, Williams & Co. The meeting was held at the Athenaeum, Indianapolis, October 4, and attended by 150 members and their guests.

Chairman F. W. Shipley, Caterpillar Tractor Co., and Frank Steinebach, Penton Publishing Co., at Central Illinois Chapter's October 4 meeting.

Mr. Snyder's talk was highlighted by a printed form distributed among the audience showing proper methods of cupola starting, and by blackboard diagrams and illustrations during the talk. Mr. Snyder presented much detailed information on latest cupola developments designed to be of particular aid to jobbing foundries.

Chester Sears, assistant foundry metallurgist, International Harvester Co., Indianapolis, acted as technical chairman of the evening and introduced the speaker and led a 45-minute question and answer session following the address.

Paul Harlan, Electric Steel Castings Co., Indianapolis, outlined the program for the Purdue Metal Castings Conference, November 4 and 5, held in conjunction with Purdue University and the Michiana Chapter, A.F.S., at Lafayette. Concluding the meeting, Chairman Robert Langsenkamp, Langsenkamp-Wheeler Brass Works, gave a financial report on the chapter picnic.

Northwestern Pennsylvania

James J. Farina
American Sterilizer Co.
Chapter Reporter

FOUNDRY PATTERNMAKING was the subject of an enlightening and informative address given by E. T. Kindt, Kindt-Collins Co., Cleveland, before the first dinner meeting of the season, held September 27 at the Moose Club, Erie. The meeting was well attended.

Following a lively question and answer period on Mr. Kindt's address, Clarence McKinney of Erie gave a coffee talk on "Our Unseen Enemy—the Communist." Mr. McKinney was forceful in his condemnation of this national menace and offered several suggestions on how to combat Communism in the United States. This address was one of a series arranged by Chapter Vice-Chairman Joseph Shuffstall, National Erie Corp., and featuring local civic and industrial leaders.

A song fest, with Courtney Wilcox, Cascade Foundry Co., at the piano, and with Earl Strick, Erie Malleable Iron Co., leading the singing, rounded out the program.

Central Ohio

H. W. Lownie, Jr.
Battelle Memorial Institute
Chapter Reporter

"MAN-TO-MAN on the Molder's Bench," was the title of a talk by Dr. Ralph Lee, Department of Public Relations, General Motors Corp., at the October 11 meeting. Ninety-one members attended the first dinner and meeting of the season.

In commenting upon a visit to Battelle Memorial Institute during the afternoon, Dr. Lee pointed out that science has developed a tremendous array of instrumentation to determine the facts regarding physical, chemical and mechanical behavior. In spite of this imposing array, he said, science has been unable to develop similar instrumentation to measure human behavior. This inability is particularly noteworthy because human behavior is the controlling factor in governing application of data obtained from existing instrumentation.

Surprised by the camera during an earnest discussion at Wisconsin Chapter's September meeting are, left to right: Chapter President R. C. Woodward, Bucyrus-Erie Co.; Harry Ladwig, Allis Chalmers Mfg. Co.; and Chapter Treasurer George Tisdale of the Zenith Foundry Co.

In discussing human behavior and the ability of people to get along with each other, Dr. Lee presented four facts which he has developed in his numerous personal contacts, and which he held to be the basis for dealings between people. They are:

1. Every human is different from every other human. Because of these inherent differences, it is impossible to treat people on a mass-production basis. Each person

A.F.S. National Director Bruce L. Simpson, National Engineering Co., Chicago, speaking at the September 17 meeting of the Washington Chapter. Listening are, left to right: Vice-Chairman E. D. Boyle, Puget Sound Naval Shipyard; Director James Tracy, Salmon Bay Foundry; E. J. McAfee, Puget Sound Naval Shipyard.

Judging from the expressions on the faces at the speakers' table at Saginaw Valley's October 7 dinner meeting, the food must have been good. Left to right: Technical Chairman D. D. Bowman, Almont Mfg. Co.; Guest Speaker L. E. Everett, Lester B. Knight & Associates, Chicago; Chapter Chairman O. E. Sundstedt, General Foundry and Manufacturing Co.

should be handled individually if he is to be handled successfully.

2. People are what they are because they cannot change as much as they would like to.

3. No person acts the same all the time. The conditions to which a person has recently been exposed have a definite effect upon his behavior at any given time. Unusual actions on the part of the individual can often be traced to some unusual stress placed upon him.

4. Every human is proud of the inherent differences in his makeup that set him apart from others. This pride usually results from the fear of being ignored. Good relations between men usually require that each take at least a moderate interest in what the other is doing.

Each of these facts was illustrated by pointed examples taken from Dr. Lee's own experiences.

A discussion period followed the talk. In answer to one question about the future of young college graduates in the foundry industry, Dr. Lee stated that college graduates usually have an appreciable advantage over men with less formal education. However, he cautioned, formal education in itself should not be considered as a recommendation for a high position. The graduate should be considered on an equal basis with non-graduates until one of them has demonstrated an ability to handle more difficult problems, Dr. Lee said.

Saginaw Valley

K. H. Priestley
Vassar Electroloy Products, Inc.
Chapter Reporter

"CHEVROLET GRAY IRON FOUNDRY NIGHT" was the designation of the chapter's first meeting of the 1948-49 season, held October 7 at the Fisher hotel, Frankenmuth. There were 176 members and guests in attendance, including 40 members of the Chevrolet Gray Iron Foundry staff, who were individually introduced to the membership by John F. Smith, of Chevrolet.

Technical Chairman Donald D. Bowman of the Almont Mfg. Co. introduced the speaker of the evening, L. E. Everett of Lester B. Knight & Associates, Inc., Chicago. The speaker's topic was "Foundry Modernization," in which Mr. Everett stated that foundry modernization does not mean mechanization, but that mechanization is one phase of modernization.

The speaker's discussion was divided into three parts, namely: management and organization, quality for profits, and facilities.

Mr. Everett dealt with each division at length and stated that he placed management and organization ahead of facilities because the foundry industry is still an art and not a science. The meeting closed with a discussion period.

No. Illinois-So. Wisconsin

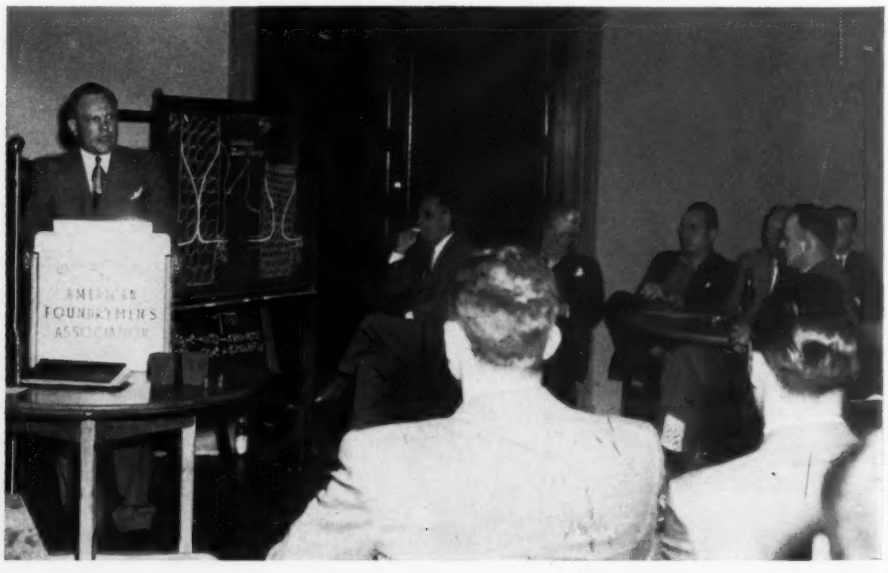
Upton E. Bartlett
Alloy Castings, Inc.
Chapter Reporter

FOUR FREEPORT FOUNDRIES were open for visitation October 12, preceding the regular chapter meeting at the Senate hotel, Freeport, Ill. Ninety members and guests attended the regular meeting and heard J. A. Gitzen, president, Delta Oil Products Co., Milwaukee, speak on "The Chemical, Physical and Mechanical Properties of Binders in Cores and Molds."

During the all-day plant visitations preceding the meeting, the Arcade Mfg. Div. of Rockwell Mfg.

(Continued on Page 94)

Ford Snyder, Hickman, Williams & Co., Chicago, guest speaker of the evening had an attentive audience at Central Indiana Chapter's first meeting of the 1948-49 season, held October 4 at the Athenaeum, Indianapolis.



FOUNDRY Literature

Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

Gray Iron Specifications

NV101—A four-page bulletin, "Summary of Gray Iron Specifications," released by Gray Iron Founders' Society, Inc., contains a resume of 14 separate sets of gray iron specifications covering automotive, high pressure, high temperature, alloy, railroad, pipe, pipe fittings and general castings. Specifying authorities include ASTM, SAE, ASA, American Association of Railroads, Army, Navy, Federal Government, American Transit Association and others. Prepared under the guidance of the Society's Technical and Specifications Committee, the summary is expected to be particularly useful to designers as a guide in the proper selection of iron for specific applications. Foundries should also find it helpful in preparing castings to specifications. Copies are available free.

Tin Content Indicator

NV102—Model 2870 Tin Content Indicator for Solder is described in Wheelco Instrument Co.'s Educational Bulletin No. 8. Operation of the Indicator, which depends upon the differential temperature measurement made of a reference material (lead) and the "unknown material" (tin-lead alloy) while these materials are concurrently passing through their transformation points, is described in detail. Complete specifications are included, together with operational diagrams.

Hardfacing Alloys

NV103—A hardfacing booklet, covering Air Reduction Sales Co.'s new line of Airco hardfacing alloys includes data on typical uses, specifications, application technique, deposit hardness, color markings and deposit analysis, and contains authentic information on combatting wear and increasing work-life . The 16-page, two-color booklet also serves as a hardfacing catalog.

Die-Less Duplicating

NV104—A new edition of the 40-page Di-Acro Catalog, describing Die-Less Duplicating is offered free of charge by the O'Neill-Irwin Mfg. Co. Described in the booklet are operational methods and applications of the system and more than a dozen different types of Di-Acro machines for bending, shearing, punching, notching and forming machines. The booklet is profusely illustrated with detailed photographs of the company's products and their applications. Included is an announcement of the availability of Di-Acro Engineering Service, offered free of charge.

Precision Investment Casting

NV105—Precision investment casting as a means of cutting costs when screw machine work, die-castings or sand castings that can be easily machined prove impractical, is covered in Bulletin 19B6451A offered by the Allis-Chalmers Mfg. Co. Illustrated are 24 sample parts, ranging from a stainless steel thermometer clamp for the dairy industry to bronze bearing blocks for a high speed precision camera. These represent only a small part of the hundreds of different parts precision cast at Allis-Chalmers. The bulletin also tells the type of materials that can be precision cast, closeness to which tolerances can be held, the limit to the shapes and designs that can be cast, physical properties, etc. Those interested in finding out whether a specific part can be economically precision cast are invited to send without obligation a drawing of the part and a sample to the nearest Allis-Chalmers sales office, together with information on quantities required, type of materials and permissible tolerances.

Metallizing Equipment

NV106—A catalog of the complete line of Metallizing Engineering Co.'s Metallizing equipment and supplies describes metallizing guns for every purpose, air and gas controls, spray booths and dust collectors, blast machines, nozzles, and air compressors. Each piece of equipment is clearly illustrated and described. Three new accessories are introduced in the catalog: (1) A Wire Control and Straightener Unit, (2) A Gas Flow Meter Unit, (3) An Air Control Unit. Catalog 401 is gratis.

Centri-Merge Arrester

NV107—Two catalogs, Nos. 480 and 481 are announced by Schmieg Industries, Inc., engineers and manufacturers of plant equipment. Catalog 480 describes the Schmieg Centri-Merge Spray Booths for the elimination of paint overspray, and shows photographs and blueprint reproductions of typical plant installations. Catalog 481 offers comprehensive information concerning other Schmieg equipment, including dust and fume control units, spray booths, mechanical washers, industrial ovens and sheet metal equipment and other Schmieg accessories.

Breaker Core Shape

NV108—A ready-made refractory breaker core shape that will save time, material and money in making better quality production castings with necked-down, easily-removed risers is described in a four-page illustrated folder recently released by Harbison-Walker Refractories Co. Developed through joint research of H-W laboratories and the Steel Founders' Society of America, the shape is now available to all foundries. Recommended dimensions of refractory breaker core shape for each riser diameter are given in a chart. Also available from Harbison-Walker is a four-page color pamphlet describing H-W Universal Cupola Blocks. The unique design of these blocks permits linings of any diameter to be made without cutting, and close-fitting curves assure a tight joint regardless of cupola diameter. Chart shows number of pieces required for various cupola diameters.

Impregnating Castings

NV109—Copies of a report on impregnation of castings of various metals, made by the Cosma Laboratories Co., Cleveland, Ohio, are available upon request from the Waterlox Division, Empire Varnish Co.

Aluminum Data Book

NV110—A handy, pocket-size 162-page book, the "Aluminum Alloys & Mill Products Data Book," published by the Reynolds Metals Co., is complete with 163 tables of data, plus 33 pages of explanatory text covering a wide range of related subjects, such as the Alloy Designation System, the Temper Designation System, heat-treatable and non-heat-treatable alloys, casting alloys, casting methods and foundry practice. In addition, wrought aluminum mill products and methods of producing them are described. A section on surface finishes for aluminum is also included, as is a discussion of the physical, chemical and mechanical properties of aluminum. Book carries separate, detailed itemized cross-index for text and tabular material, and a condensed table of contents on the title page is included. This handy, wire-bound 6 x 9 in. book is available without charge to engineers, designers and technical men who request it on their company letterhead.

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NEW Foundry Products

Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

Iron Welding Electrode

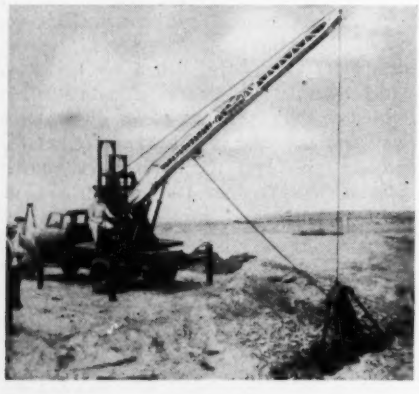
NV1—A 100 per cent nickel electrode for producing machineable welds on cast iron without preheating the metal, is announced by Hobart Brothers Co. In using the Hobart Nickel-cast electrode, welds are machineable both in the deposit and the line of fusion and may be drilled, tapped or machined at any point in the weld zone. Nickelcast is free from fluorides and will not produce injurious gases. The coating is insulated to prevent arcing through when working in confined quarters. Nickel-cast electrodes can be used with either a-c or d-c welding current and are available in 3/32", 1/8", 5/32" and 3/16" diameters.

Abrasive Belts

NV2—Abrasive belts, designed with a resin bond to provide extra durability and heat resistance, are announced by the Minnesota Mining & Mfg. Co. "Three-M-Ite" Resin Bond Cloth Belts are available in widths up to 18 in. and in lengths from 60 in. up, and consist of aluminum oxide mineral grains in grits from 24 to 120, coated on a flexible cloth backing with a resin bond.

Hydrocrane

NV3—A 3-ton capacity Hydrocrane, announced by the Hydrocrane Division of Bucyrus-Erie Co., is designed for the economical handling of small jobs on which



the use of a conventional crane-excavator would prove too expensive. Full hydraulic operation of crane eliminates shafts, drums, gears, clutches, brakes, chains and sprockets—is easy to maintain. All functions, including closing action of the 3/8 yd clamshell bucket, and the 370 degree swing are hydraulically controlled and there is no need to synchronize hand and foot motions. Machine is almost weatherproof and operates equally well in 100 degree or sub-zero temperatures. Supplied as a complete mobile package, unit is factory-mounted on a new motor truck. The H3 has overall length in travelling position of 24 ft 6 in., overall height of 10 ft 6 in., and features hydraulic telescoping boom, which extends from 18 to 26 ft.

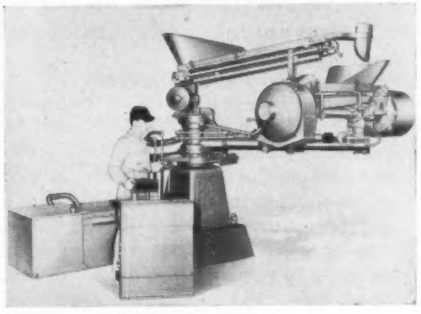
Telescopic Worksaver

NV4—A tilting model, 120-in. telescopic Worksaver—the highest lifting "walkie" available—is announced by Yale & Towne Mfg. Co. Designed to make possible maximum use of available headroom in high-stacking operations, the telescopic Worksaver has a capacity of 3,000 lb. High reach feature can be used profitably in

reaching such levels as mezzanines, in servicing overhead cables and ducting, in loading planes, street trucks, and rail cars from the ground level. Reach is accomplished by means of a ram-within-a-ram. When outer hydraulic piston has fully extended upward, an inner one extends downward, doubling the lift available. Truck travels at 2 mph under full load, lifts 8 fpm with 2,500 lb load and tilts a full 18 degrees in 10 seconds. Total weight of truck, including 19-plate battery, is 3,640 lb. Dimensions—33 in. x 64 in.—make it desirable in narrow aisles.

Hydra-Slinger

NV5—A stationary type sandslinger with hydraulic power controlling and directing movement of the ramming arms is announced by Beardsley & Piper, Division of Pettibone-Mulliken Corp. From the control station, the operator directs the movement of the ramming head over the mold with ease, accuracy and speed. The control station may be placed at a choice of locations adjacent to the ramming area



and may be at floor level or elevated to provide the most desirable visibility for a particular installation. Arm lengths provide a choice of ramming ranges.

Portable Compressor

NV6—Latest addition to Ingersoll-Rand Co.'s line of portable compressors is the Pac-Air—a self-contained, completely air-cooled, gasoline engine-driven unit. The two-cylinder, single-stage compressor has a piston displacement of 37.5 cfm at 80 psi pressure and is equipped with an automatic unloader, which permits the compressor to operate at constant speed, but compress air only when needed. Compressor and driver are mounted on an air receiver which forms an integral part of the running gear. 6.00 x 16 pneumatic tires and a quickly-detachable ball-and-socket type trailer hitch makes it easy to tow.

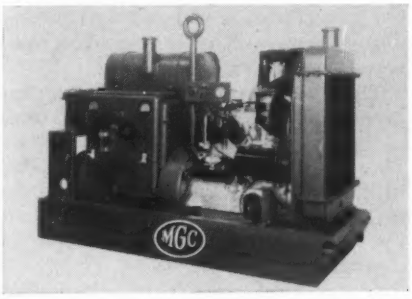
Radiant Electric Heaters

NV7—Glassless, glareless, all-metal electric radiant heaters with high test intensity and utilizing almost the entire infrared band are announced by the Edwin L. Wiegand Co. The heaters are designed for drying, baking, preheating and dehydrating where a longer-wave infrared heat source is desired and where rugged construction is preferable. The new Chromalox heater has a high-temperature, enclosed type heating element mounted in a rigid extruded aluminum body with a reflector sheet of polished aluminum. Glassless construction permits an unobstructed, unfiltered path of infrared radiation of the longer wave lengths. Unit operates at temperatures from 1000 F to 1400 F. User

has choice of wattage ratings to suit operating conditions. Available in body lengths of 25, 31 and 47 in., with respective heated lengths of elements, 17, 23 and 29 in.; standard height is only 4 in. Other lengths can be made as required.

Magnet Generators

NV8—A complete new line of gasoline engine driven generators to supply power for handling scrap or pig iron with magnet cranes has been developed by the Motor Generator Corp. Compact and light-



weight, these magnet generators are available in six sizes, ranging from 5 kw to 25 kw, and are without canopies for easy installation in operator's cab. A commercial, automotive type gasoline engine is standard, but diesel engines can be furnished at extra cost. Engines are connected directly to and on a common structural steel base, and are drip proof, ball-bearing mounted and rated for continuous duty. All models furnished complete with six-volt battery ignition, push-button starter, radiator and fuel tank, fully assembled for service.

Air Conditioner

NV9—A small air conditioning unit, designed to protect crane operators against the hazards of excessive heat, dust, fumes and noxious gases, has been developed by Dravo Corp. The new model is about half the size of the C-5 Dravo crane cab cooler used to condition cabs of cranes operating in extremely high temperatures. Designed for operation in ambient temperatures up to 130 F, the unit will maintain cab temperatures at 80° to 85° in the summer and 68° to 72° in the winter. A vertical unit, it can be mounted alongside a crane cab or placed on adjoining catwalks. Only a power supply line is needed for installation. Unit also removes dirt, dust, gas fumes and odors from the cab.

Bin Aerator

NV10—An aerating device to provide uniform and steady flow of materials from bins, hoppers and chutes, is announced by the Bin-Dicator Co. Bin-Flo provides a new and economical solution to the restriction and stoppage of bulk materials in bins and chutes. The unit is a small plate readily located at points where flow is restricted. Low-pressure air is injected into the material through a special fabric diffuser, causing the material to flow freely. Units will not plug-up with the most finely ground material and are applicable to most dry, finely-ground materials. Can be used in conjunction with Bin-Dicators or installed independently. Models are provided for thin-walled bins and chutes and for concrete and other thick-walled hoppers. Piping can be run either outside of thin-walled bin or inside of thick-walled container. The company will be glad to make suggestions and specify unit types and mountings to fit specific cases.

Radiograph Illuminator

NV11—Panels of translucent plexiglass are now being used in radiograph illuminators made by the General Electric X-Ray Corp., to provide evenly diffused light necessary to accurate interpretation. Acrylic plastic plexiglass is used in ⅛ in. sheets measuring 14 x 17 in. and replaces opal glass because of its superior diffusing quality, uniform density, freedom from flaws and high shatter resistance.

Magnetic Tester

NV12—An entirely new method of magnetizing parts in several directions at the same time for inspecting casting defects has been developed for application in Magnaflux Corp.'s Duovec Inspection Units. This method permits parts to be inspected for defects in any direction with one magnetizing operation and one visual inspection operation instead of the usual two or more magnetizations and inspec-

tions. The Duovec system comprises the application of two magnetizing forces simultaneously. Parts are placed between the heads on the unit, where they are magnetized in both directions in one shot while inspection bath is applied.

Protective Masks

NV13—A protective mask, consisting of a plastic shield held in place by an adjustable head band, and replaceable laminated filters of extra thickness, has been developed by the General Scientific Equipment Co. Weighing less than ½ oz, these masks are cool and comfortable and protect throat, nose and bronchial tubes from the larger particles of non-toxic dusts that irritate membranes. G-S masks are particularly recommended for use in foundries or practically anywhere except where toxic dusts are present. Masks are extremely economical and easily refillable.

Overhead Truck Guard

NV14—Latest addition to the Lewis-Shepard line of attachments for power fork trucks is the Heavy Duty Canopy Type Overhead Guard. Constructed of heavy tubular arc-welded steel and supported at four points on the fork truck, this guard affords complete protection to the operator from falling objects, not only those carried by the truck, but also those stacked alongside the route of travel. An expanded metal screen to fit over the horizontal portion of the guard is available where required. Guard is detachable and so designed that it can be adapted to fit every model of Lewis-Shepard gasoline or electric-powered fork truck.

Lubricated Belt Idler

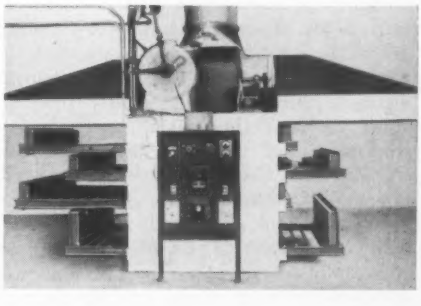
NV15—Designed for use wherever the movement of bulk material is indicated and the principle of belt conveying is practical Palmer-Bee Co.'s new "lubricated for life" idler is sturdy, quality-built and of simplified construction. Idler rolls are identical for each width of belt, are easily removed by hand and completely interchangeable. The new feature, "lubricated for life" ball bearings, eliminates "down time" resulting from replacement and repair due to improper greasing or abrasives in the bearings, along with all greasing.

Roughness Tester

NV16—A handy, pocket-size surface roughness comparator for sight and feel comparison with machined finishes has been developed by the General Electric Co. The Surface Roughness Scale is composed of two small rules 6 in. long and 1¼ in. wide. These illustrate degrees of roughness ranging from the smoothness of a bearing surface to the roughness of a flame cut. One side of each scale is divided into 12 surfaces, depicting 24 different surfaces grouped into 10 degrees of surface roughness. Every degree is identified by a number designating the nominal roughness in micro-inches (average). Comparator and leather case, weigh only 3 oz.

Core Oven

NV17—A dual-end drawer type core oven, developed by the Lanly Co., makes



it possible to load one end of a drawer while the other is baking. Baking space is utilized 100 per cent at all times and represents an approximate 60 per cent capacity increase over the conventional single-end type oven of the same size. Smooth, jarless drawer action is made possible by ball bearing arrangement, enabling very fragile cores to be handled without need for reinforcement. Smokeless exhaust system completely eliminates objectionable smoking when drawer of cores is pulled.

ABSTRACTS OF FOUNDRY ARTICLES

Gray Iron

ADVANTAGES. Frederick G. Sefing, "Unappreciated Advantages of Modern Gray Iron," *Mechanical Engineering*, Aug., 1948, pp. 667-670, 674.

Outstanding advantages of gray iron are: resistance to wear and galling; resistance to corrosion by water and by heat; low tendency toward warping under heating and cooling; high capacity to dampen vibration; high notch fatigue strength; good compression and torsional strength; electrical resistivity to some extent; low cost of forming; good machinability.

Properties which are definitely lowered by the presence of graphite are: tensile strength and modulus of elasticity. Cast irons with high strength and other properties attainable at extreme levels are associated with alloy conditions, and sometimes heat treatment.

Gray iron has many engineering applications in which other metals cannot be used so readily or economically. Among these are jobs requiring wear resistance as in the case of piston rings, and corrosion resistance such as is required by papermill, textile, and food mill driers. Heavy duty uses of modern gray iron requiring high strength, high damping capacity, and high wear resistance are found in machine tools, brake drums, etc.

Casting Design

TESTING INOCULATED CAST IRON. H. M. Hardy and T. O. Kuivinen, "Strain Testing Improves Iron Alloy Machine Parts," *Product Engineering*, vol. 19, no. 8, August 1948, pp. 116-120.

The usual procedure for interpretation of strain test readings is not correct for inoculated cast irons as these alloys depart from a straight (constant modulus) line at low stress values and the shape of the curve varies for different analyses and cooling rates. The best practice is to determine the stress-strain curve of a specimen taken from the part being tested. When the applicable stress-strain curve is available, the stress for any measured strain can be determined directly from the curve. A correction has to be made for sections under combined stress because stress in one direction affects strain normal to that direction.

Investigations were made on the possibility of reducing stress concentration at the crankpin fillets of a crankshaft designed for a 9 in. bore diesel engine. It was statically loaded in a 200,000 lb hydraulic testing machine. In each test Stresscoat was used to determine the most highly strained regions, and then SR-4 strain gages having ¼ in. gage length were applied and measured.

High stress concentration was found in the crankpin fillet. Stress concentration was reduced by removing metal from the inner side of the crankweb, increasing the effective radius of the crankpin fillet.

Strain gages measuring bending at the broadest part of the crankweb had shown low strain levels so the crankwebs were milled off to 10 in. width. No change in the fillet resulted.

These tests formed the basis for a redesign of the crankshaft for less stress and less weight. A change in oil hole drilling made use of straight cylindrical cores possible. The crankweb was reduced more than 2 in. in breadth.

Cast compressor cylinders are so complicated in form and loading that it is impossible to calculate the operating stresses with fair approximation. Old designs become too cumbersome for current high operating pressures. Strain gages may be used with loading similar to operating conditions, with satisfactory measurement of operating strains.

All external openings of the cylinder studied were sealed off and static fluid pressure was applied to the cylinder. This means that all passages are at the same pressure instead of suction pressure at one side and discharge pressure in the other. To measure strains in the pressure space gages and wires had to be sealed against electrical leakage to the fluid and wires had to be brought outside, both pressure sealed and insulated from metal.

Strain tests showed the most highly stressed location was at the inner edge of the valve hole at the bore intersection.

It was necessary to put the stressed section in initial compression. The redesign incorporated one transverse steel bolt on each side of each valve hole.

A series of four different inoculated cast iron beam sections—circular, rectangular, a fairly thick I-section, and a thin H-section—were strain tested to extend knowledge of the relationship of the calculated stress at the breaking load to the ultimate tensile strength. This information is for designing castings to be stressed in service in the fatigue range.

In using high and medium strength iron beams it was found that, for practical stress calculation, the normal bending theory can be used with sufficient accuracy. About 10 per cent should be deducted from a rotating beam endurance limit value in designing I-section beams.

The experimental work indicated that plane transverse sections remain plane after bending, and longitudinal stress is not proportional to longitudinal strain for inoculated cast irons.

Cupolas Water Cooled

SPECIAL TUYERES AND PERMANENT BOTTOM. E. S. Kopecki, "Water-Cooled Cupola Features Duplexing Plant," *The Iron Age*, vol. 162, no. 8, August 1948, pp. 81-85.

The Central Iron and Steel Co., Harrisburg, Pa., investigated the possibilities of the use of cupola metal for open-hearth steelmaking operations. To do this a new cupola was constructed. Certain design changes incorporated these features:

1. Water cooling of cupola bosh lining to minimize accelerated erosion usually encountered in overheated refractories;

2. A tuyere design differing from the conventional design, being an assembly of accurately machined components. The steel, cast iron and bronze tuyere sections (latter water cooled) are tapered slide fits and prevent escape of air blast between shell and lining, the bronze one being flush with the lining;

3. Use of increased blast pressure;

4. Use of carbon paste on well bottom;

5. Permanent bottom instead of drop bottom construction.

Three cupolas are used, two for continuous tapping, the third is tapped intermittently—about 4 tons every 20 minutes. Efforts are being made to tap at longer intervals by lengthening the vertical distance from the bottom of the tap hole to the bottom of the tuyeres. This does not decrease the production rate.

A slag hole was constructed to allow for slag removal without need for turning off the blast and without interruption of the melting of the metal. This also allows for the accumulation of more metal in the hearth. This minimizes tap hole erosion. Any repairs are expected to be of a minor nature that will not interfere with melting operations.

Iron-Carbon Alloys

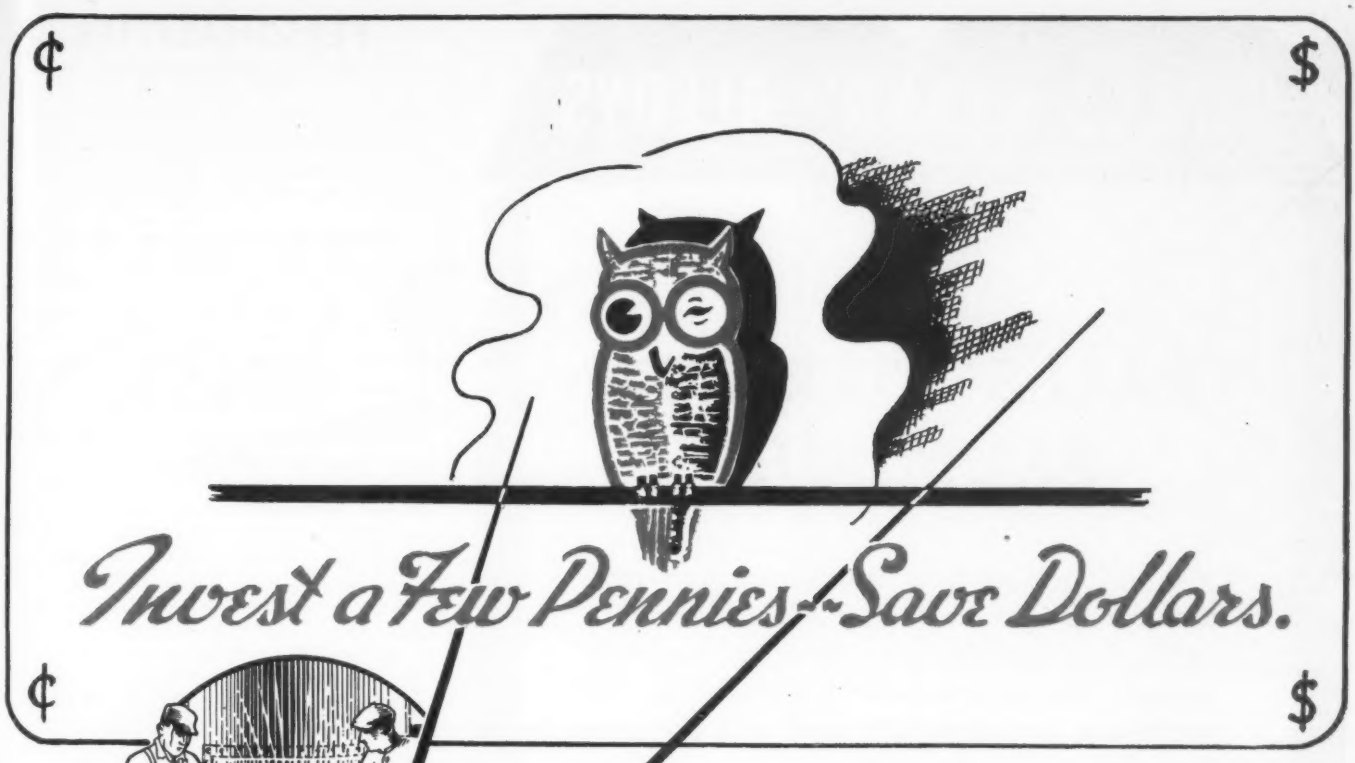
VISCOSITY. E. T. Linacre, "A Critical Survey of the Viscometry of Molten Iron-Carbon Alloys," *Iron and Steel*, vol. 21, no. 8, July, 1948, pp. 315-318, vol. 21, no. 9, August, 1948, pp. 363-366.

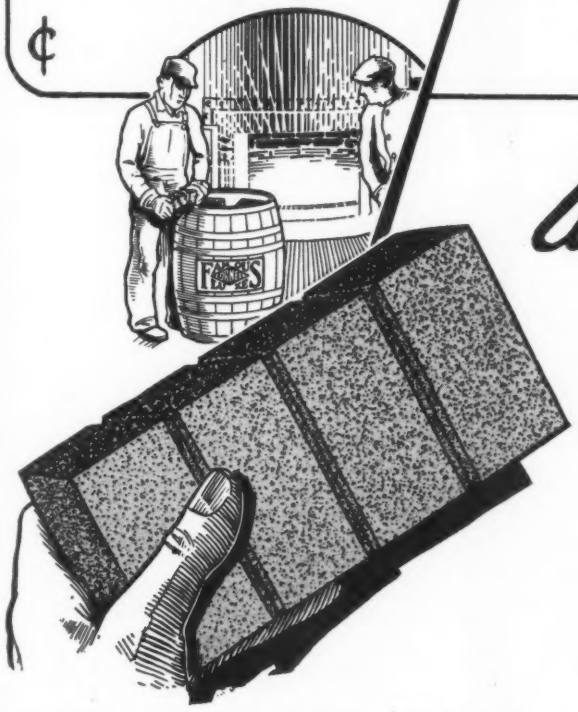
This review deals solely with the viscometry of high carbon iron (i.e. 2%-4%) since measurements of the viscosity of low carbon steels apparently have not been made because of the higher melting point.

Measurements of the viscosity of molten white cast iron, type of viscometer used, and methods of viscometry are presented.

The author studied the work of Oberhoffer and Wimmer on molten white cast iron; Thielman and Wimmer on the viscosity of cast iron; Saito and Matsukawa on molten white cast iron and other metals and alloys; and the work of Gessner on molten white cast iron. That of Gessner did not agree with the results of the others and Mr. Linacre believes this may be due to surface oxidation or to the apparatus.

The apparatus of Wimmer consisted of a cylindrical spindle suspended on an elastic wire. It carried a mirror, scale, and telescope for measuring the amplitude of the swings. The molten iron, with spindle immersed, was contained in a cylindrical vessel heated in a small electric furnace. The spindle was rotated slightly by being blown, and allowed to swing about its vertical axis. From the rate of decay of the amplitude of these oscillations, read from the scale, an estimate of the viscosity could be made. Later the entire apparatus was enclosed which together with other changes, permitted the molten iron to be in an inert atmosphere during the experiment. This apparatus was the best for the study of viscosity of steel.





Use Famous CORNELL CUPOLA FLUX

SOUNDER CASTINGS. Famous Cornell Cupola Flux purges molten metal of impurities. You pour castings of uniform grain and unusually free from hard spots, hollow centers, etc. Furthermore, there is a very noticeable reduction in sulphur.

SMOOTHER MACHINING. Uniform grain and freedom from hard spots, etc. make castings easier to machine.

FEWER REJECTS. Reduction in make-overs will save you time, money and delays in shipment.

CLEANER CUPOLAS. Bridging over is practically eliminated. Drops are cleaner. Maintenance is practically nil.

Write for Bulletin 46-B

The Only Molten Iron Flux in Scored Brick Form.

Saves time and labor in using.

You simply toss Famous Cornell Cupola Flux into cupola for each ton charge of iron or break off one to three briquettes (quarter sections) for smaller charges. Flux in this form does not blow out with the blast but STAYS in melting zone until entirely consumed, thus insuring fullest efficiency.

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Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

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Famous CORNELL ALUMINUM FLUX

Produces clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections are poured. Castings take a higher polish. NO FUMES! Exclusive formula prevents obnoxious gases. Metal does not cling to dross.

Famous CORNELL BRASS FLUX

Makes metal pure and clean, even when dirtiest brass turnings or sweepings are used. Produces castings which withstand high pressure tests and take a beautiful finish. Saves considerable tin and other expensive metals. Crucible and furnace linings are preserved.

Famous CORNELL LADLE FLUX

Place a few ounces in bottom of ladle, then tap cupola. Metal is thoroughly cleansed, foreign impurities are easily skimmed off. Ladles are kept clean, there is less patching and increased ladle life. Metal temperatures are retained during transfer to molds.

"FALLS BRAND" ALLOYS
AMERICA'S LARGEST PRODUCERS OF ALLOYS

"FALLS" TITANIUM ALUMINUM

When added to aluminum-copper and aluminum-silicon alloys will dissolve readily at ordinary foundry melting temperatures. It has a favorable influence on the grain-size and structure and will promote the following properties:

... Increase tensile strength and ductility.

... Increase fluidity.

... Increase resistance to pressure so that castings will hold liquids without leakage.

... Improves polished and machined surfaces due to decreased subsurface pinholes and porosity.

"FALLS" Titanium Aluminum, produced in most convenient size ingot for weighing small quantities, is recommended for addition to molten aluminum alloy just before it is poured into the mold.

Write to Us for Detailed Information

NIAGARA FALLS
Smelting & Refining Division
Continental-United Industries Co., Inc.
BUFFALO 17, NEW YORK

PERSONALITIES

(Continued from Page 73)

trade association work, having been affiliated with national associations of lighting fixture manufacturers and steel foundries prior to assuming his present position.

William Wraith, consultant engineer to the Andes Copper Mining Co., Chile Exploration Co., Inspiration Consolidated Copper Co. and Green Cananea Copper Co., and former vice president of the American Institute of Mining and Metallurgical Engineers, will be the recipient of the AIMME's James Douglas Gold Medal for 1949. This award is made from time to time in recognition of distinguished achievement in non-ferrous metallurgy. Simultaneously, it was announced that **Stanley Alexander Easton,** president of the Bunker Hill & Sullivan Mining and Concentrating Co., will receive the 1949 W. L. Saunders Medal for distinguished achievement in mining. The late **Harry Carothers Wiess,** president of the Humble Oil & Refining Co., will be posthumously awarded the Charles F. Rand Medal for achievement in mining administration.

Gordon A. Weller has been appointed assistant manager of Replacement Sales and **Frank A. Colosimo** chief service engineer of the American Brakeblok Division of the American Brake Shoe Co. Mr. Weller, a graduate of Yale University, was formerly a sales representative for the company. Mr. Colosimo has been in development and research work with the company since 1934. He is a graduate of the University of Detroit. Both men will be located at Division headquarters.

C. W. Staacke, for 22 years a member of the engineering staff of B. F. Goodrich Co., has joined Hewitt-Robins, Inc., New York, as technical consultant on belt conveyors. Mr. Staacke will coordinate research and development activities of the company's divisions at Buffalo, N.Y., Passaic, N.J., and New York City.

Walter D. Binger was recently elected a director of the National Radiator Co., Johnstown, Pa. Mr. Binger is vice-president of the City Investing Co., and president of the City Construction Co., both of New York City. He was formerly a commissioner of the New York City Administration and was in charge of design and construction of the East River Drive and Island Sewage Treatment Works. He is chairman of the National Technological Advisory Committee and consultant to the Office of the Secretary of Defense.

Carl L. Petty, Jr., has been named district sales manager for A. P. Green Fire Brick Co., replacing John Bing who recently resigned to become general manager of Metropolitan Refractories Corp., New York (AMERICAN FOUNDRYMAN, September 1948, page 77). Mr. Petty, whose office will be in Chicago, has been with A. P. Green since May 1936 when he started working in various departments in the plant in Mexico, Mo. In March 1942 he became

(Continued on Page 92)

Grind Better

WITH

SIMONDS ABRASIVE CO.

RESINOID BONDED SNAGGING WHEELS

WITH

RED STREAK

TRADE MARK REG. U. S. PAT. OFF.

PATENT 2,121,636

FLANGES

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Philadelphia, Pa.
Grinding Wheels and Abrasive Products

SIMONDS CANADA ABRASIVE CO. LTD.
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Special Steels

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Simonds Products for Canada

LESS GRINDING MACHINE MAINTENANCE. Better spindle fit (steel against steel) . . . no abrasive wear on machine parts. Red Streak Flanges consist of circular steel flanges or plate embedded and bonded into each side of wheel adjacent to center hole and lining portion of it.

LONGER GRINDING WHEEL LIFE. Wheel is protected at center hole, safeguarding against damage in mounting and handling . . . preventing chipping sides and edges . . . assuring better balance, truer running.

BETTER GRINDING WHEEL ACTION. Mount center and flanges keep true and accurate. In manufacturing, the abrasive and bond are mixed and pressed to shape in a single unit, assuring uniformity of entire wheel.

For more snagging production at lower cost, use Simonds wheels with patented Red Streak Flanges. Available with 6, 10 and 12 inch center holes in all popular wheel sizes. See your Simonds Abrasive distributor. Meanwhile send for Red Streak Flange Bulletin ESA-154.

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DISTRIBUTORS IN ALL PRINCIPAL CITIES

THE BEST PATTERNS COME FROM THE BEST PATTERN LUMBER

. . . and the best pattern lumber comes from Dougherty. Processed in our own kilns . . . using only old growth logs to give you patterns that resist cracking and warping . . . here's lumber that will reduce pattern costs because it is easier to work and has fewer flaws.

- BENCH LUMBER • CRATING
- FLASK LUMBER • PLYWOOD
- BENCHES • HARDBOARD
- DOWELS • WEDGES • SKIDS
- BOTTOM BOARDS
- FOUNDRY MALLETS

DOUGHERTY LUMBER CO.

CLEVELAND, OHIO
YOUNGSTOWN, OHIO
PITTSBURGH, PA.
WILLOW RANCH, CALIF.
LAKEVIEW, OREGON

PERSONALITIES

(Continued from Page 90)

office manager of the Chicago branch office and in December entered the Air Force. Overseas 14 months, he saw service in England and Germany, returning to the Chicago office in March 1946. Mr. Petty handled sales in the south industrial section of Chicago until assuming his new position in July.

John W. Horner, Jr., vice-president and manager of Slack-Horner Brass Mfg. Co., Denver, Colo., was in Chicago during the latter part of October to look at foundry equipment and materials. He is secretary of the Timberline Chapter. Mr. Horner's latest paper, *"Asbestos Additions Improve Nonferrous Foundry Sands,"* appeared in the September 1948 issue of AMERICAN FOUNDRYMAN, pages 59-62.

James H. Anderson has been appointed assistant professor in the engineering department of San Jose State College, San Jose, Calif. Now teaching a course in materials and processing, he expects to set up courses in metallurgy and metallography for the engineering department. A former member of the University of Minnesota Student Chapter of A.F.S., Prof. Anderson is a graduate of Minnesota and taught foundry practice there after his discharge from the Army.

C. P. Corrigan, formerly sales representative, has been appointed Cleveland district sales manager for the Ramapo Division of the American Brake Shoe Co. Since joining Brake Shoe in 1939, Mr. Corrigan has held several positions in both the sales and purchasing departments of the company. A graduate of Princeton University, he served with the Seabees in World War II.

Obituaries

John Eckels, superintendent of the Erie Bronze Co., Erie, Pa., died at his home in that city on September 20. Mr. Eckels had more than 50 years service in various capacities in Pennsylvania foundries. He began his career with the Mesta Machine Co., Pittsburgh, and from 1912 to 1930 was assistant superintendent and superintendent of General Electric Foundries at Erie. He was with the Erie Bronze Co. from 1930 until his death.

Aldus C. Higgins, 75, chairman of the Executive Committee of the Norton Co., Worcester, Mass., died at his home in Worcester, September 10. Mr. Higgins joined Norton in 1900 as a patent counsel. He had since that time served in every important executive capacity with the company, including those of president, general manager and chairman of the Board of Directors. On his birthday this year, Mr. Higgins was decorated by the Swedish Consul-General on behalf of King Gustaf in recognition of his outstanding contributions to industry and art. Mr. Higgins' collection of stained glass, early Flemish tapestries, and modern French paintings was nationally-known. Mr. Higgins is survived by his widow, a daughter and a son, Milton, who is president of the Norton Co.

"ELECTROMET" VANADIUM

Trade-Mark

FOR THE PRODUCTION OF FINE STEELS

VANADIUM GIVES STEEL . . .

- ★ HIGH STRENGTH
- ★ INCREASED DUCTILITY
- ★ GOOD WELDABILITY
- ★ ABRASION RESISTANCE
- ★ TOUGHNESS

Springs, axles, and other parts of the trucks of high-speed diesel locomotives are made of vanadium steel. Vanadium is also used in steel for tools and machinery parts because of the exceptional properties that it imparts.

Vanadium improves steel by increasing its yield strength and its ductility. Vanadium-bearing steels are tough—because of their uniformly fine grain size—and resist abrasion, fatigue, and impact. They are especially suitable for parts subject to high dynamic stress.

Vanadium steels are readily cast, forged, and rolled. They are also easily machined, and have exceptional weldability. When vanadium is added to steel in quantities ranging from 0.05 to 0.20%, heat-treatment is simplified. Its use results in a tough, strong, wear-resisting surface on case-carburized parts.

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Electromet

TRADE-MARK

Ferro-Alloys and Metals

CHAPTER ACTIVITIES

(Continued from Page 80)

Co., Burgess-Parr Co., Fairbanks-Morse Co., and Woodmanse Mfg. Co. opened their foundries to visitors under arrangements made by Bruce Whiting, chief engineer of the Woodmanse Co.

The Arcade Mfg. Division of the Rockwell Mfg. Co. produces power tools for the home workshop and foundry molding machines. Primarily a gray iron foundry, a small amount of brass is poured for small, plated hardware such as hinges. Intricate thin-walled housings and other parts for power tools are poured at the rate of 30 tons of castings per day. The foundry has one large cupola, and has a sand control laboratory. Due to material shortages, this foundry is using some briquetted machine turnings and some briquetted coke.

Burgess-Parr Co., makes corrosion resisting castings by centrifugal and static casting methods. There are two small horizontal rocking barrel type indirect arc melting furnaces for melting about a 10-lb charge, and two small centrifugal casting machines using dry sand molds. A small electric arc furnace melts about 500 lb for static casting. Illium (Ni 56%, Cr 24%, Cu 8%, Mo 4%) is poured here exclusively under rigid melting control. Pouring temperature of the metal is 2900 F, solidification time of metal in core mold is 3 min, while speed of rotation of centrifugal casting machine is about 800 rpm. Metal yield is over 98 per cent.

The Fairbanks-Morse plant manufactures ½ to 10 hp electric motors. The foundry is large and mechanized, pouring 30 tons of steel castings per day. No pig iron or steel scrap is used. This foundry uses only cleaned and dried machine borings or turnings in the charge. A large conveyor loop carries molds; there are 16 molding stations. Mold weights are suspended from a monorail and are automatically lowered prior to pouring. Travel of conveyor and monorail is synchronized.

An electric furnace is used for melting and molten metal is poured from ladles suspended on monorail. After molds are poured, they move on the conveyor through a cooling tunnel leading outdoors. The molds reenter the other end of the building via the cooling tunnel to the shakeout operation. Molds are automatically dumped onto the shakeout screen, while the bottom board remains on the conveyor. A spectrographic check is made on the molten metal once every hour as a melting control. In the sand laboratory periodic checks are made on the properties of molding sand and sand core mixtures.

Woodmanse Mfg. Co. produces windmills, galvanized steel towers, deep and shallow well pumps and pump jacks. This small gray iron foundry has one medium-sized cupola. Castings poured here are mostly pump parts. Not mechanized, the foundry has some special mold-handling devices.

At the regular evening meeting, the speaker, Mr. Gitzen classified the different types of core binders into groups and outlined the purpose of each group, its history, and the development of new methods to meet changing foundry problems.

Water, Mr. Gitzen said, is the

(Continued on Page 96)

• "Lined half of melting zone 36" high with Buckeye 12" x 6" x 6" hand cut cupola blocks, and other half of melting zone was lined with ——. We melted 100 tons in about six hours. Buckeye blocks burned off approximately 1½" with no holes and very uniform wear. Opposite side will require considerable patching."
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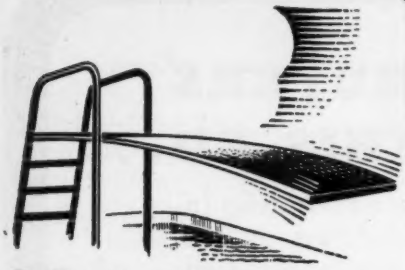

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MOLY

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CHAPTER ACTIVITIES

(Continued from Page 94)

most misused material in the foundry. It is cheap, but when used to excess in foundry sand it becomes expensive because it takes more heat in core baking. Also wet sands tend to stick in flasks and core boxes, resulting in poorly made molds or cores, Mr. Gitzen added.

Too much linseed oil is oftentimes used, he said. Linseed oil produces gases which occupy 700 times the original volume of the oil when the hot metal enters the mold. Water likewise produces steam in considerably greater volume than the original volume of the water, hence these materials should be used with discretion.

Mr. Gitzen added that linseed oil binder in itself will not impart hot strength as in a strainer core. Some inorganic binders such as silica flour and iron oxide are necessary to give the core mixture the necessary hot strength, he concluded. A lively and prolonged discussion period followed Mr. Gitzen's talk.

Missouri School of Mines

J. E. Reynolds
Chapter Program Chairman

THE MISSOURI SCHOOL OF MINES Student Chapter held its first meeting of the 1948-49 season Wednesday evening, September 22 and featured a talk by W. E. Illig, vice-president, Banner Iron Works, St. Louis, a member of the St. Louis District Chapter. Mr. Illig outlined the opportunities existing in the foundry industry for young metallurgists, and his presentation left a lasting impression upon the student members. Chairman A. L. Hunt of the St. Louis District Chapter welcomed new student members and extended the cooperation of his group. There were 12 members of the St. Louis Chapter present at the meeting. Interest in the student chapter is evident from the increased number of applications for membership that have come in since the first meeting of the season.

Texas

W. H. Lyne
Hughes Tool Co.
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"RECENT DEVELOPMENTS in Foundry Refractories" was the featured address at the October 15 meeting of the Texas Chapter, held

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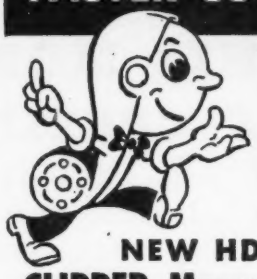

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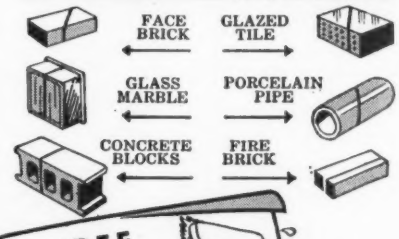

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at the Texas State hotel, Houston.

The speaker, James H. Rickey, Jr., production engineer, Ironton Firebrick Co., Ironton, Ohio, whose ceramic engineering background from Ohio State University well qualifies him to speak on the subject, stressed the necessity for proper installation, prefiring and operational use of refractories to obtain maximum service.

Mr. Rickey described recommended methods of lining cupolas, ladles and electric furnaces with brick and monolithic type linings. The talk was followed by a spirited question and answer program in which members of the local refractory trade, as well as foundrymen from all over Texas took part.

Northeastern Ohio

R. H. Herrmann
Penton Publishing Co.
Chapter Reporter

"CUTTING COSTS IN THE COREROOM" was the subject of an address by L. P. Robinson, director of Core Oil Sales, Werner G. Smith Co., Cleveland, speaking before the September meeting of the chapter.

According to Mr. Robinson, it is possible to make a core with any kind of sand and any binder, but not necessarily a good core. Sands for cores should be free from clay and organic matter, which tend to absorb the binder and require larger additions. While clay provides green strength, he added, it is better practice to provide that property through use of a small amount of cereal binder. One foundry saved about $8000 a year in the coreroom by changing from a cheap bank sand to a relatively expensive clay-free sand, Mr. Robinson said. With the former the sand-oil ratio was 26 to 1; the mixture required large additions of flour and caused trouble in baking. After changing sand, the ratio was 60 to 1 with only a small amount of cereal, and baking was rapid and uniform, the speaker said.

Use of dry sand eliminates the variable of moisture in preparing mixtures and permits addition of a definite amount to provide the workability of the sand. While the highest strength is obtained without water, Mr. Robinson said permeability is low and sand is hard to handle. Excess moisture causes sticking in the corebox and de-

(Continued on Page 98)

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CHAPTER ACTIVITIES

(Continued from Page 97)

creases the film value of the core oil. Moisture content should be known so that the proper amount of oil is added.

Lack of intelligent help in preparing core mixtures and use of poor measuring devices are costly, according to Mr. Robinson. A "wheelbarrow load" of sand in the morning means considerably more sand than in the late afternoon when the worker is tired, consequently, the sand ratio will vary. Use of battered and misshapen cans for measuring oil and other binders prevents any approach to uniform additions of these materials, Mr. Robinson said.

Cereal binders, he said, are used in oil-sand core mixtures primarily to provide green strength and the usual range for good practice is from ½ to 1 per cent. Additions beyond that range, according to Mr. Robinson, increase cost without commensurate improvement in core properties.

In speaking on mixing, Mr. Robinson said that for every combination of sand and binders there is a proper mixing time for the best results. This should be determined by the foundry and rigidly adhered to. Many foundries have found it worth while to install counters or timers on mulling equipment, which stops the machine after a pre-determined period of operation, according to the speaker.

Baking, said Mr. Robinson, can cause more trouble than all of the other factors. Since definite temperatures and periods of time are required to bake a core properly, these must be followed reasonably closely. Increasing the temperature merely skin dries or case hardens the surface, leaving the interior green; and baking the second time does not remedy the condition. Overbaking at a proper temperature tends to destroy the bond, resulting in cores which are eroded by the flowing stream of metal. Ovens having poor heat distribution will produce some cores which are overbaked and some which are underbaked. Hence, Mr. Robinson concluded, it is economical to install equipment which will give uniform heat distribution and produce cores which are all baked properly.

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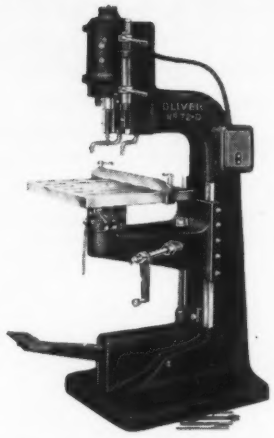

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Here is a concise discussion of the techniques of employing copper as an alloying element in cast and wrought steel and iron. It includes a correlated treatment of the influences of copper in promoting the hardenability of steel . . . in raising the ratio of yield to tensile strength and other mechanical properties of various steel products . . . and in replacing a large portion of the silicon content in cast iron to improve wear resistance, machinability, scaling, and corrosion resistance. Covered thoroughly are the known characteristics of cast copper steels, wrought copper steels, copper cast iron, and copper malleable iron, including a representative list of the uses of each of these materials in various industries.

Order from
American Foundrymen's Society
222 W. Adams St.
Chicago 6, Ill.

LITERATURE

(Continued from Page 81)

Steel Analysis

NV111—An eight-page folder recently published by the Wilkens-Anderson Co. features a series of technical articles on the determination of phosphorus, molybdenum, chromium, nickel, manganese, vanadium and combined nitrogen in steel.

Nickel Steel

NV112—"Nickel Alloy Steel Castings in Industry" is the title of a 32-page, handsomely illustrated brochure published by the International Nickel Co. Included are specifications, chemical and mechanical properties and applications for nickel steel for use in railroad equipment, oil production, excavating and dredging, construction projects, oil refining and chemical equipment, power plants, mining, milling and smelting, and miscellaneous applications. Each type of casting is described in detail and illustrated. Included in the brochure are sections on depth hardening, welding, advantages of nickel steel castings and charts for selection of compositions for industrial castings.

Aluminum Casting Alloys

NV113—A manual on aluminum casting alloys and their applications is now available from the Aluminum Association. Written by Floyd A. Lewis, engineer, editor and writer, the contents of the manual first appeared in the March, 1948, issue of *Materials and Methods*. Known as "Materials and Methods Manual 35," the pamphlet describes the various types of sand, permanent mold, and die-casting alloys available and presents their physical and mechanical characteristics in tabular form. Application data included cover factors to be considered in selecting both the alloy and casting process best adapted to various classes of application, and finishing procedures, stress analysis, and heat treatment are discussed. Available gratis.

Vanadium

NV114—Alloys, metals and chemicals produced by the Vanadium Corporation of America are the subjects of a recently-published, 38-page booklet. Applications and properties are listed for ferro vanadium, vanadium metal, vanadium pentoxide, ammonium meta-vanadate, chromium, ferro chromium, high carbon ferro chromium, low carbon ferro chromium, iron foundry ferro chromium, silicon, ferro silicon, titanium, alsifer, and grainal alloys.

Electromet Products

NV115—Electro Metallurgical Co. has available free of charge technical booklets and reprints including "Electromet Products and Service" and "Electromet Ferro Alloys and Metals."

Polishing Compound

NV116—Bulletin No. 208 issued by Burrell Technical Supply Co. features a new metallographic polishing compound, "C-RO." Also included in the folder are other metal polishing supplies and compounds.

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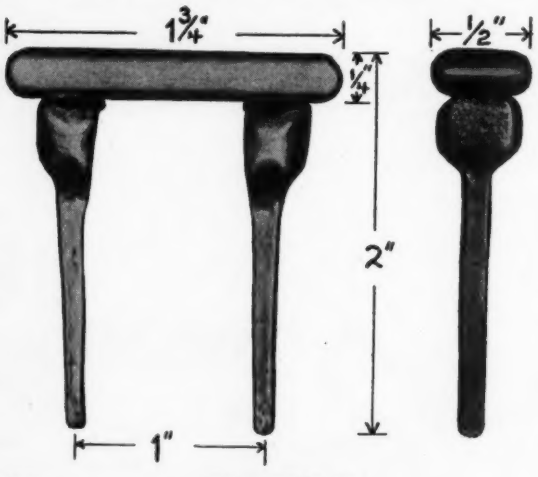

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FIRM FACTS

The name of the J. W. Murphy Co. has been changed to **Meters and Controls, Inc.** The organization handles control and recording instruments including electronic devices for recording temperature and pressure of oxygen and carbon dioxide.

National Carbon Co., Inc., announces that it will build a new graphite electrode plant at a location to be specified later. The company now operates electrode plants at Clarksburg, W.Va., Columbia, Tenn., and Niagara Falls, N.Y.

The Atomic Energy Commission's **Office of Chicago Directed Operations** recently assumed the research service contract formerly held between the Oak Ridge Directed Operations Office and Battelle Memorial Institute, Columbus, Ohio. The contract involves research and services in the field of metallurgy.

Universal Engineering Corp., Cedar Rapids, Ia., was recently purchased by the **Pettibone-Mulliken Corp.** of Chicago. Universal has been a leading manufacturer of crushing, screening, washing and loading equipment. The acquisition of Universal Engineering is third such made by Pettibone-Mulliken in recent years. The company also owns the Beardsley & Piper Co. of Chicago, and George Haiss Mfg. Co., Inc., New York.

John Best & Associates, Toronto, Ont., machinery distributor, has been appointed Canadian distributor for **Buckeye Tools Corp.** of Dayton, Ohio. Mr. Best has had more than 20 years' experience in the portable tool field, and his organization covers every province of Canada.

Battelle Memorial Institute, Columbus, Ohio, announces that it will begin construction of a half-million dollar laboratory building this year. Scheduled for completion in 1949, the addition will be the largest of four laboratories erected since the war. The three-story structure will contain space for 103 unit laboratories, plus areas for pilot plant operations.

National Cylinder Gas Co. announces the removal of its executive headquarters to 840 N. Michigan Ave., Chicago. The seven-story building, recently purchased by the firm will house the executive offices and administrative departments, including legal, personnel, credit, engineering, advertising, accounting and purchasing, and will serve as headquarters for sales offices.

Superior Foundry, Inc., Cleveland, played host to officials of the Gray Iron Research Institute on September 16. Institute officials were conducted through all departments of the foundry and attended a luncheon at the Statler Hotel, where they were addressed by Dr. E. L. Stromberg, consulting psychologist of the Personnel Research Institute of Western Reserve University. The afternoon was devoted to a discussion of the morning's plant visitation. After dinner, the entire group was taken to see the Cleveland-Washington ball game as guests of Superior Foundry, Inc.

Exothermic Research Products, Buffalo, N.Y., has been formed by A. H. Colwell and Earl R. Pierce to conduct research in foundry problems. Special attention will be given to feeding of castings. As a result of research and field tests improved exothermic materials for feeding castings and fluxes for ferrous and non-ferrous metals are expected to be developed by the new company.

The new steel foundry of **Dominion Engineering Works Ltd.,** Montreal, Que., now under construction is expected to be in operation in January 1949. The 50-man foundry is scheduled to cast 300 tons monthly of carbon and low alloy steels, and eventually will cast Hadfield's steel. Castings will be produced for such Dominion Engineering products as hoists, derricks, paper mill machinery, hydroturbines, etc. Of steel and brick construction, the new foundry will be an extension of the present iron foundry and will contain a sand conditioning and distribution system, and a mechanical shakeout. Molds will be made by machine and handled on roll conveyors. A 5-ton direct-arc electric furnace will be installed for melting.

Quebec Iron and Titanium Corp. will construct a new titanium smelter at Sorel, Que., at a cost of approximately $25 million. .Organized jointly by Kennecott Copper Corp. of New York and New Jersey Zinc Co. of Palmerton, N.J., the new company initially will ship $5 to $10 million worth of titanium slag annually to the United States. The titanium slag will be separated from iron ores obtained from the Lac Allard district in Quebec.

Baldwin Locomotive Works will add $7,500,000 to its working capital by selling to **Westinghouse Electric Corp.** 500,000 shares of authorized but unissued $13.00 par value Baldwin common stock. Gwilym A. Price, president of Westinghouse, and Charles E. Brinley, chairman of the board of Baldwin, issued the following joint statement on July 29:

"For many years Westinghouse and Baldwin have collaborated closely in the development and design of various types of railroad locomotives. The acquisition by Westinghouse of a substantial but minority common stock interest in Baldwin is a natural step which should materially benefit both companies through the strengthening of the cooperation which has existed in the past. It will now be possible to take full advantage of the experience, know-how, and plant facilities of both companies which will place Baldwin-Westinghouse in a favorable position to meet competition."

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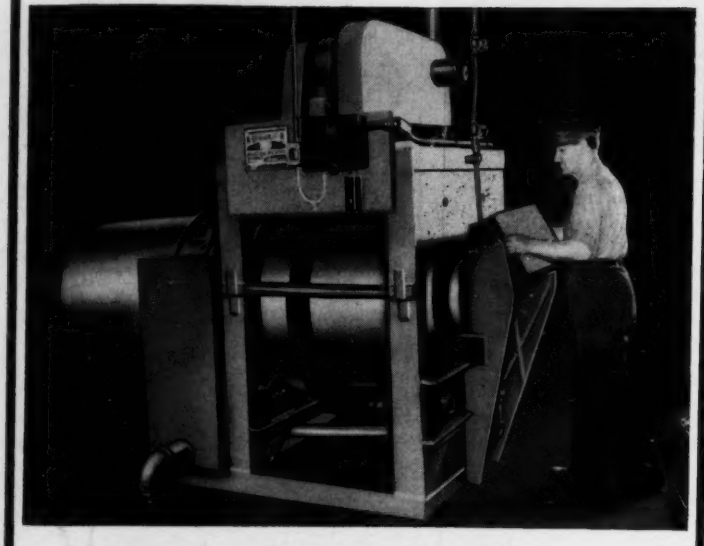

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